“A COMPARATIVE STUDY OF DEXMEDETOMIDINE AND ESMOLOL IN INDUCED HYPOTENSION FOR FUNCTIONAL ENDOSCOPIC SINUS SURGERY”

Dissertation submitted in partial fulfillment of

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M.D. ANAESTHESIOLOGY- BRANCH X

CHENGALPATTU MEDICAL COLLEGE, CHengalpattu

THE TAMILNADU DR. M.G.R. MEDICAL UNIVERSITY

CHENNAI, TAMILNADU.

APRIL 2015

CERTIFICATE

This is to certify that this dissertation titled "**comparative study of dexmedetomidine and esmolol in induced hypotension for functional endoscopic sinus surgery**" has been prepared by Dr .B. Rajesh under my supervision in the department of anesthesiology, chengalpattu medical college and hospital, chengalpattu during the academic period 2012-2015 and is being submitted to the Tamil Nadu Dr. M.G.R. Medical university, Chennai in partial fulfillment of the university regulation for the award of the Degree of Doctor of Medicine (Branch –X MD anesthesiology) and his dissertation is a bonafide work.

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DECLARATION

I, **Dr.RAJESH .B**, solemnly declare that the dissertation **"A COMPARATIVE STUDY OF DEXMEDETOMIDINE AND ESMOLOL IN INDUCED HYPOTENSION FOR FUNCTIONAL ENDOSCOPIC SINUS SURGERY"** is a bonafide work done by me in the Department of Anaesthesiology, Chengalpattu Medical College & Hospital, Chengalpattu, after getting approval from the Ethical committee under the able guidance of **Prof.Dr. SUGANTHARAJ ANURADHA M.D.,D.A.,** Professor & HOD, Department of Anaesthesiology, Chengalpattu Medical College, Chengalpattu.

Place : Chengalpattu

Date : **(Dr.RAJESH.B)**

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Last but not least, I thank all the patients for willingly submitting themselves for this study.

INSTITUTIONAL ETHICS COMMITTEE

CHENGALPATTU MEDICAL COLLEGE , CHENGALPATTU

APPROVAL OF ETHICAL COMMITTEE

To

Dr.B.Rajesh
Post Graduate
Dept of Anaesthesia

Dear Dr.

The Institutional Ethical Committee of Chengalpattu Medical College reviewed and discussed your application to conduct the clinical / dissertation work entitled

INDUCED HYPOTENSION FOR FESS (FUNCTIONAL ENDOSCOPIC SINUS SURGERY) - A COMPARATIVE STUDY OF DEXMEDITOMEDINE VS ESMOLOL

On 13.11.2013

The following documents reviewed

a. Trial protocol, dated _____version no
b. Patient information sheet and informed consent form in English and / or vernacular language.
c. Investigators Brochure, dated _____version
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The following members of the Ethics committee were present at the meeting held on

Date 13.11.2013 Time 12.00 Noon Place Chengalpattu Medical College

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Name of each member with designation

Clinical Members

1. Dr.G.Raja Billy Graham MS.,
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7. Lawyer : Lr. I. M. Karimala Basha

8. Layperson : Mr.Dilli

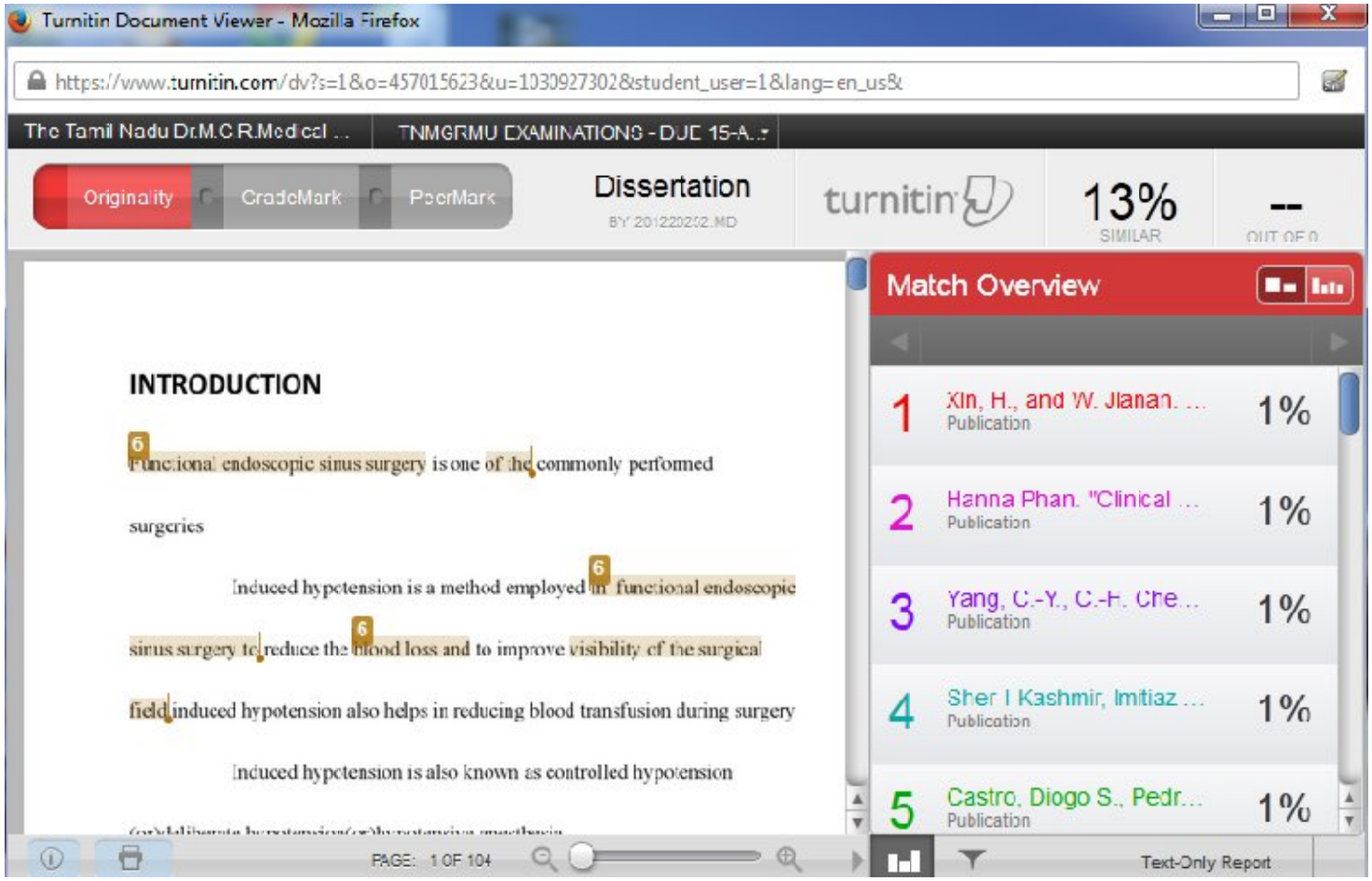
We approve the clinical trial to be conducted in its presented form

The Institutional Ethics Committee expects to be informed about the progress of the study and any SAE occurring in the course of the study, any changes in protocol and patient information / informed consent and asks to provide copy of final report.

Yours sincerely

13/11/13

Member secretary, Ethics Committee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INTRODUCTION
Functional endoscopic sinus surgery is one of the commonly performed surgeries
Induced hypotension is a method employed in functional endoscopic sinus surgery to reduce the blood loss and to improve visibility of the surgical field.induced hypotension also helps in reducing blood transfusion during surgery
Induced hypotension is also known as controlled hypotension
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ABBREVATION

Paco2	-	partial pressure of carbon di oxide in arterial blood
Fio2	-	inspired oxygen concentration
ECG	-	electrocardiogram
ETCO2	-	end tidal carbon di oxide
CSF	-	cerebro spinal fluid
COPD	-	chronic obstructive pulmonary disease
MAP	-	mean arterial pressure
FESS	-	functional endoscopic sinus surgery
ASA	-	American society of anaesthesiologist

ABSTRACT

OBJECTIVE

To compare the effectiveness and advantages of using dexmedetomidine and esmolol in induced hypotension for functional endoscopic sinus surgery.

METHODS

Fifty patients belonging to ASA 1 planned for functional endoscopic sinus surgery were randomly divided into two group's. Dexmedetomidine group received a bolus dose of 1 microgram/kg over 10 minutes followed by infusion at a rate of 0.4-0.8 microgram /kg/hr. Esmolol group received a bolus dose of 1 mg/kg over one minute followed by infusion at a rate of 0.4-0.8mg/kg/hr. The target mean arterial pressure was 55-65 mm hg. General anaesthesia was maintained with 60% N20:O2 .Induction dose of propofol, haemodynamic variable's (blood pressure and heart rate) ,intra operative serum cortisol, quality of surgical field, emergence time, post anaesthesia recovery score(modified aldrete score>9), sedation score at 15 ,30 and 60 minute's, time for rescue analgesia were recorded.

RESULT

Dose of propofol was lower in dexmedetomidine group than esmolol group. Heart rate and blood pressure were comparable in both groups intra operatively ,when target mean arterial was achieved. Quality of surgical field and

intra operative serum cortisol level’s were comparable in both group’s. Emergence time and time to achieve aldrete score > 9 were higher in dexmedetomidine group than esmolol group. Sedation score’s were higher in dexmedetomidine group than esmolol group at 15 ,30 minute’s post operatively. Time for rescue analgesia was prolonged in dexmedetomidine group than esmolol group.

CONCLUSION

The use of dexmedetomidine in induced hypotension for functional endoscopic sinus surgery has additional advantage of sedative ,analgesic and reduced requirement of anaesthetic agent’s than esmolol.

INTRODUCTION

Functional endoscopic sinus surgery is one of the commonly performed Surgeries.

Induced hypotension is a method employed in functional endoscopic sinus surgery to reduce the blood loss and to improve visibility of the surgical field. Induced hypotension also helps in reducing blood transfusion during surgery.

Induced hypotension is also known as controlled hypotension (or)deliberate hypotension (or) hypotensive anesthesia. Induced hypotension also prevents progressive stretching of the vessel wall during vascular surgery, which enables easy suturing and clipping in aortic surgery , AV malformations and aneurysmal surgeries.

Esmolol is an ultrashort acting beta blocker and dexmedetomidine is a highly selective alpha 2 adrenergic agonist .

Hence,the above study was done in the department of anaesthesiology, chengalpattu medical college,Chengalpattu.

AIM

The aim of the study was to compare the effectiveness and advantages of using dexmedetomidine and esmolol in induced hypotension for functional endoscopic sinus surgery.

HYPOTENSIVE ANESTHESIA

Induced hypotension is a method employed to improve the quality of the surgical field and to minimize the complications associated with blood transfusion.

HISTORY

- Induced hypotension was first proposed by Harving cushing for neurosurgery in 1917.
- Gardner was the first to practice induced hypotension in surgery by arteriotomy.
- Griffith and gillies used high spinal anesthesia for producing Hypotension.
- Enderby used ganglionic blockers for induced hypotension and he also insisted on the importance of posture in induced hypotension.
- Sodium nitroprusside was first used hypotensive anesthesia by Moraca in 1962.
- Dimant used cardiac pacemakers for hypotensive anesthesia in 1967.
- Nitroglycerine and labetalol were used for induced hypotension in 1970.

PHYSIOLOGY OF INDUCED HYPOTENSION

During hypotensive anesthesia adequate blood flow should be maintained to vital organs in order to prevent end organ damage.Blood flow to many vital organs such as heart,brain,kidneys and liver is autoregulated, which enables them to be perfused over a wide range of perfusion pressures.

OBJECTIVES

- Maintain systolic blood pressure between 80-90mm hg.
- Maintain mean arterial pressure between 50-65mm hg.
- Maintain mean arterial pressure 30% of baseline value in hypertensive patients.
- A close communication between surgeon and anesthetist is necessary in order to maintain optimal surgical conditions without compromising end organ perfusion.
- Critical perfusion pressure varies for different organs and individuals.

CENTRAL NERVOUS SYSTEM

- Cerebral blood flow is autoregulated between 50-150mm hg.

- During hypotensive anesthesia when cerebral blood flow reduces more the cerebral metabolic rate, cerebral ischemia develops.

- Volatile anesthetics used in hypotensive anesthesia attenuate the cerebral autoregulation.

- Vasodilators used in hypotensive anesthesia attenuate the cerebral autoregulation.

- Head end elevation in hypotensive anesthesia also reduces the cerebral blood flow.

RESPIRATORY SYSTEM

- Ventilation perfusion mismatch can occur during hypotensive anesthesia due to use of head end elevation.

- Increase in paco2 can be due to inhibition of hypoxic pulmonary vasoconstriction leading to increase in intra pulmonary shunting.

- In order to avoid hypoxia higher fio2(0.4-0.5) should be used during hypotensive anesthesia.

CARDIOVASCULAR SYSTEM

- Coronary blood flow decreases during hypotensive anesthesia, but corresponding decrease in myocardial oxygen demand prevents development of myocardial ischemia in healthy individuals.

- Hypotensive anesthesia, when used in patients with coronary artery occlusion can cause redistribution of blood flow leading to myocardial infarction.

RENAL SYSTEM

- Hypotensive anesthesia causes decrease in glomerular filtration rate leading to oliguria in intraoperative period.

- Adequate hydration should be maintained in order to avoid postoperative renal dysfunction in hypotensive anesthesia.

HEPATIC SYSTEM

- Hepatic functions are not affected by hypotensive anesthesia.

INDICATIONS

1) Neurosurgery-AV malformations, cerebral aneurysm surgery, vascular tumour surgery, trans sphenoidal hypophysectomy.

2) Major orthopaedic surgery-total hip and knee replacement,spine surgery.

3) ENT surgery-functional endoscopic sinus surgery,middle ear surgery.

4) Head and neck surgery-faciomaxillary tumors, radical neck dissections, larygectomy.

5) Ophthalmic surgery-orbital surgery , vitrectomy, intraocular tumors

6) Major pelvic and gynaecological surgeries

7) Plastic and reconstructive surgery

8) Jehovas witness

CONTRAINDICATIONS

1) Ischemic heart disease

2) Cerebrovascular disease

3) Hepatic dysfunction

4) Renal dysfunction

5) Severe respiratory disease

6) Diabetes mellitus

7) Uncontrolled hypertension

8) Bleeding diathesis

9) Allergy to hypotensive agents

10) Severe anemia

11) Lack of knowledge of the technique

12) Lack of adequate monitoring

13) Patient refusal

METHODS OF HYPOTENSIVE ANESTHESIA

PHYSICAL MEASURES

- **Head end elevation-**Elevation of head end of the patient helps to prevent blood loss during surgery, but head end elevation is associated with the risk of air embolism.

- Head end elevation causes pooling of blood in the lower extremities leading to decrease in venous return to the heart and cardiac output.

- **Positive pressure ventilation-**Positive pressure ventilation reduces venous return to the heart, which can be further reduced by prolonging the inspiratory time and by applying positive end expiratory pressure.

PHARMACOLOGICAL AGENTS

Characteristics of a ideal hypotensive agent

- Easy to administer

- Rapid onset of action

- Hypotensive effect should disappear rapidly on discontinuation

- Rapid elimination

- No toxic metabolites

- Negligible effect on vital organs
- Predictable effect
- Dose dependant effect

GANGLIONIC BLOCKING AGENTS

- They produce hypotension by blocking both sympathetic and parasympathetic outflow from autonomic ganglia.
- **Pentamethonium and hexamethonium** were initially used in hypotensive anesthesia.
- **Pentolinium** is a highly potent agent, devoid of tachycardia due to effective sympathetic blocking action.
- **Trimethaphan** has additional direct vasodilating property and histamine releasing property , which enhances it's hypotensive effect.
- **Trimethaphan** has very short duration of action of 1-2 min's and it is metabolised by plasma cholinesterase.

ALPHA ADRENERGIC BLOCKERS

- Alpha blockers produce hypotension by blocking alpha 1 receptors in blood vessels leading to vasodilatation.

- **Phentolamine** is a short acting alpha blocker used in hypotensive anesthesia.
- **Phentolamine** has rapid onset of action ,it's plasma level reaches a peak within 2 min's.
- **Phentolamine** is usually administered in bolus doses of 2 -5 mg.
- **Labetalol** is a combined alpha and beta blocker.
- **Labetalol** has more potent action on beta receptors when compared with alpha receptors.
- **Labetalol** has rapid onset of action with peak plasma concentrations reaching within 5 min.
- Advantages of labetalol include lack of rebound hypertension, lack of tachycardia, tachyphylaxis.
- Contraindications for labetalol are patients with heart block, bradycardia, conduction block, congestive cardiac failure and hypovolemia.

VASODILATORS

1) **SODIUM NITROPRUSSIDE**

- Mechanism of action-sodium nitroprusside acts by production of nitric oxide.Nitric oxide diffuses across the cell membrane and

stimulates guanylate cyclase, which inhibits intracellular release of calcium leading to relaxation.

- Nitroprusside has rapid onset of action within 1 min.
- Dose of nitroprusside is 0.5-10 microgram/kg/min.
- Metabolism-Cyanide released from nitroprusside combines with thiosulfate to form thiocyanate in the liver in the presence of enzyme rhodanase. Cyanide also combines with hydroxylcobalamine to form cyanocobalamine.
- Complication-Important complication associated with nitroprusside is cyanide toxicity.
- Cyanide can combine with cytochrome oxidase in the electron transport chain leading to histotoxic hypoxia.
- **Manifestations of cyanide toxicity**

  1) Resistance to high infusion doses of nitroprusside
  2) Metabolic acidosis
  3) Elevated lactate levels
  4) Hypotension not responding to fluids and vasopressors
  5) Cardiovascular collapse

- **Management of cyanide toxicity**

1) Sodiumthiosulphate-it converts cyanide to thiocyanate and enables it's excretion.It is given as a bolus dose of 30mg/kg followed by infusion at a rate of 60 mg/kg/hr.

2) Hydroxocobalamine-it prevents increase in concentration of cyanide in erythrocytes. it is given as a bolus dose of 50mg/kg followed by infusion at a rate of 100 mg/kg/hr.

3) Sodium nitrite (or)amyl nitrite-it produces methemoglobin , which combines with cyanide to form cyanomethemoglobin. It is administered at a dose of 5mg/kg intravenously.

NITROGLYCERINE

- Nitroglycerine is predominantly a venodilator, it reduces venous return to the heart and produces hypotension.
- Dose of nitroglycerine is 0.5-10 microgram/kg/min.
- It has rapid onset of action and a short half life of about 2 min.
- Advantages of nitroglycerine is that it does not produce any toxicmetabolites and it does not produce rebound hypertension.

HYDRALAZINE

Hydralazine is predominantly a arterial vasodilator used to producehypotension.

NICARDIPINE

- Nicardipine is a calcium channel blocker used in inducedHypotension.
- Nicardipine is given intravenously and it has a distribution half life of14 min.
- Nicardipine should be cautiously used in patients with renal dysfunction .

ADENOSINE

- Adenosine is a potent vasodilator used in induced hypotension.
- Adenosine has a very short half life of 10-20 sec.
- Adenosine causes decrease in peripheral vascular resistance without causing increase in heart rate.
- Adenosine is infused at a rate of 6o-300microgram/kg/min.
- Advantages of adenosine is that it does not produce any rebound hypertension.

- Disadvantages –It can block the conducting system of heart leading to bradycardia. It can cause coronary steal phenomenon. It cancause accumulation of uric acid in patient with gout.

PROSTAGLANDIN E1

- Prostaglandin E1 has positive inotropic action on the heart and it causes a decrease in systemic vascular resistance.
- Prostaglandin E1 has antiarrythmic action.
- Prostaglandin E1 helps in maintaining cerebral autoregulation.
- ProstaglandinE1 used in induced hypotension helps in increasing renal blood flow and urine formation.

INHALATIONAL AGENTS

- Inhalational agents like halothane, isoflurane, sevoflurane, desflurane can be used in induced hypotension.
- Halothane is a direct myocardial depressant and it sensitizes the heart to arrythmogenic action of adrenaline.
- Isoflurane produces hypotension by decreasing the systemic vascular Resistance.
- Sevoflurane and desflurane are newer inhalational agents which produce hypotension without significant myocardial depression.

BETA BLOCKERS

- Beta blockers produce hypotension by decreasing the myocardial contractility and cardiac output.
- Propanolol is a non selective beta blocker used in hypotensive anaesthesia. It is administered at a dose of 0.5mg intravenously. Propanolol can produce bronchospasm in patients with bronchial asthma.
- Metaprolol is a selective beta1 blocker used in induced hypotension.
- Esmolol is a ultrashort acting selective beta 1 blocker used in induced hypotension.

REMIFENTANIL

- Remifentanil is a ultra short acting opiod used in hypotensive anesthesia.
- Remifentanil has a ester group and hence it is metabolized by plasma and RBC esterases.
- Remifentanil has a short context sensitive half life of about 4 minutes.
- Remifentanil is given at a loading dose of 1microgram/kg/min.
- Remifentanil can also be used to blunt the sympathetic responseassociated with laryngoscopy and intubation.

MONITORING IN HYPOTENSIVE ANESTHESIA

- Invasive blood pressure-Intra arterial blood pressure monitoring is gold Standard during hypotensive anesthesia for accurate measurement of blood pressure.

- ECG-Ecg is mandatory during hypotensive anesthesia to detect anycompromise in coronary blood flow.

- Pulse oxymeter-pulse oxymeter is used to make changes in FIO2 due toventilation perfusion mismatch occurring during hypotensive anesthesia.

- ETCO2-Etco2 is essential as it can be useful in estimation of blood PaCO 2 during hypotensive anesthesia.

- Temperature-Temperature should be monitored to detect hypothermia during hypotensive anesthesia.

- Urine output-urine output should be monitored to assess the adequacy of renal perfusion during hypotensive anesthesia.

FUNCTIONAL ENDOSCOPIC SINUS SURGERY

- Functional endoscopic sinus surgery is a technique to a gain access to paranasal sinuses by minimal invasive methods .

- The main aims of sinus surgery is to provide drainage to the sinus cavities and to obtain tissues from sinus cavity for pathological examination.

INDICATIONS

1) Chronic sinusitis-The most common indication of endoscopic sinus is chronic sinusitis refractory to medical treatment.

2) Turbinate reduction-Endoscopic sinus surgery is used for reduction of hypertrophied turbinates causing nasal obstruction.

3) Septoplasty-Deviated nasal septum causing nasal obstruction can be corrected by endoscopic sinus surgery.

4) Control of epistaxis-Endoscopic sinus surgery is useful in identification and ligation of blood vessels responsible for epistaxis.

5) Orbital decompression-Orbital decompression in patients with exophthalmos can be performed using endoscopic sinus surgery.

6) Repair of CSF leak-Endoscopic sinus surgery is used in repair of CSF leaks occurring through the anterior skull base.

7) Pituitary surgery-Endoscopic sinus surgery is used in performing transsphenoidal hypophysectomy.

COMPLICATIONS OF ENDOSCOPIC SINUS SURGERY

1. Injury to nasolacrimal duct can lead to excessive tearing in the post operative period.
2. Injury to medial wall of orbit can occur leading to prolapse of orbital fat and orbital haemorrhage.
3. Injury to cribriform plate of ethmoid can lead to leakage of CSF
4. Surgeries involving sphenoid sinus can lead to injury to carotid artery and optic nerve.
5. Surgeries involving frontal sinus can also result in leakage of cerebrospinal fluid.

ANESTHETIC CONSIDERATIONS IN ENDOSCOPIC SINUS SURGERY

PRE OP PREPARATION

Patients undergoing endoscopic sinus surgery are premedicated with nasal decongestant drops like xylometazoline to reduce bleeding .Steroids like dexamethasone are given preoperatively to reduce nasal edema in the postoperative period .

INTRAOPERATIVE MANAGEMENT

Endoscopic sinus surgery can either be performed under local anesthesia or monitored anesthesia care or general anesthesia. In patients with extensive disease, involvement of multiple sinuses and in patients with reactive airway disease surgery is preferably performed under general anaesthesia. Laryngeal mask airway can be used instead of an endotracheal tube as it prevents entry of blood into the stomach.Laryngeal mask airway is particularly useful in patients with reactive airway disease as it prevents coughing or buking during emergence ,which can lead to bleeding from the surgical site.

Maintainance of a bloodless field is essential during sinus surgery to improve visualization of the surgical field. It can achieved by placing pledgets soaked with vasoconstrictive agents like adrenaline or xylometazoline in the nasal cavity or by blocking the sphenopalantine

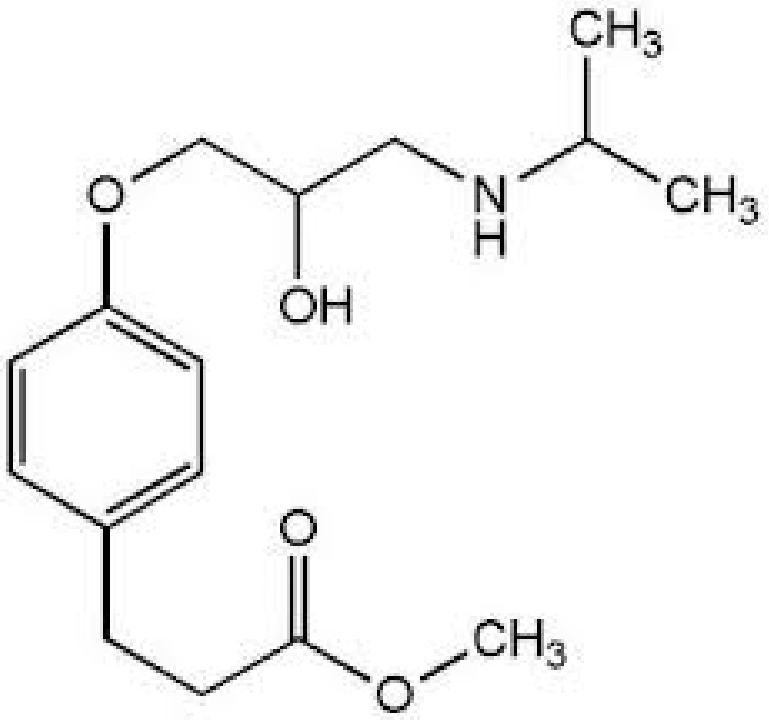
ganglion using infiltration with 1% lignocaine and 1:1,00,000 epinephrineor by inducing hypotension with hypotensive agents.

POSTOPERATIVE MANAGEMENT

Patients undergoing endoscopic sinus surgery should be monitored in the post op period as they are at the risk of aspiration of the swallowed blood .Pain relief should be given in the post op period using opioids.

PHARMACOLOGY OF ESMOLOL

Esmolol is a cardioselective ultra short acting beta blocker.The chemical name of esmolol is methyl p-[2-hydroxy-3-(isopropylamino)propoxy] hydrocinnamate hydrochloride.




NDC 63323-652-10
605210
ESMOLOL
HYDROCHLORIDE
INJECTION
100 mg/10 mL
(10 mg/mL)
For Intravenous Use
Rx only
10 mL
Single Dose Vial
Preservative Free

CLINICAL PHARMOCOLOGY OF ESMOLOL

Esmolol is a short acting agent with a elimination half life of 9 minutes .Though esmolol is a cardioselective beta blocker at higher doses it acts on beta 2 receptors present in bronchial smooth muscles and blood vessels.

PHARMACOKINETICS AND METABOLISM

Esmolol is metabolized by RBC esterases into free acid and methanol. The acid metabolite is excreted through urine and hence in patients with limited renal reserve,the elimination half life of esmolol is prolonged. The rate of clearance of esmolol was 20L/kg/hr, which is greater than the cardiac output and it's metabolism is not affected by rate of blood flow to the liver and kidneys.

Esmolol is administered at a loading dose of 1 mg/kg and the infusion dose of esmolol is 0.05-0.3mg/kg/min. With loading dose steady state plasma concentration is achieved within 5 min's. With infusion steady state plasma concentration is achieved in 30 min.

PHARMACODYNAMICS

Esmolol causes decrease in heart rate, delay in recovery of sinus node,Prolongation of AH interval during normal sinus rhythm and increase in antegrade wenckebach cycle length.

During exercise esmolol produces decrease in heart rate,blood pressure, rate pressure product,right and left ventricular ejection fraction and cardiac index. Discontinuation of esmolol is associated with return of parameters to baseline in about 30 minutes. Esmolol did not produce any adverse reactions in patients with bronchial asthma and COPD.

INDICATIONS

1) Supraventricular tachycardia-Esmolol is used in rapid control of ventricular rate in patients with atrial fibrillation and atrial flutter.

2) Intraoperative and postoperative tachycardia and hypertension Esmolol is used to blunt the tachycardia and hypertension associated with laryngoscopy and intubation and during emergence from anesthesia.

For control of intraoperative tachycardia and hypertension esmolol is administered at a of loading dose of 1mg/kg over one minute followed by infusion at a of 150microgram/kg/min.

CONTRAINDICATIONS

1) Heart block

2) Sinus bradycardia

3) Congestive cardiac failure

4) Cardiogenic shock

ADVERSE EFFECTS

- **Cardiovascular system**

Esmolol can produce hypotension, bradycardia, chest pain pulmonary edema, peripheral ischemia, syncope, heart block and even asystole.

- **Central nervous system**

Headache,paraesthesia,dizziness,anxiety,depression,asthenia,somnolence,lightheadedness,abnormal thinking, agitation and fatigue.

- **Respiratory system**

Bronchospasm, dyspnoea, wheezing, rhonchi and nasal congestion can occur.

- **Gastrointestinal system**

Dyspepsia, nausea and vomiting,constipation and abdominal discomfort can occur.

- **Skin**

Discoloration ,edema, erythema,thrombophlebitis and skin necrosis can occur.

- **Miscellaneous**

Retention of urine, visual disturbance, speech disorder,fever and rigors can occur.

DRUG INTERACTIONS

1) Administration of esmolol with morphine resulted in increase in plasma concentrations of esmolol.

2) Pharmacokinetics of esmolol was not affected by concomitant administrationof digoxin and warfarin.

3) Concomitant administration of esmolol and reserpine resulted in worsening of bradycardia and hypotension.

4) Esmolol can cause prolongation of neuromuscular blockade caused by administration of succinyl choline.

5) Esmolol should be cautiously used in patients on calcium channel blockers like verapamil as it lead to heart block and cardiac arrest.

6) Esmolol should be cautiously used along with vasopressors like dopamine, dobutamine and noradrenalin as myocardial contractility can be impaired.

7) Esmolol should be cautiously used in patients who are already on drugs which impair myocardial contractility.

8) Patients on esmolol require a higher dose of epinephrine to treat anaphylactic reactions.

TOXICITY

Esmolol overdose can cause cardiac arrest.Use of premixed injections can avoid the dilutional errors occurring with esmolol.

Management

1) Hypotension should be treated with intravenous fluids and vasopressors.

2) Bradycardia should be treated with intravenous atropine.

3) Bronchospasm should be treated with beta2 agonists.

4) Cardiogenic shock should be treated with inotropic agents like dopamine, dobutamine, isooprenaline or using inodilators like milrinone.

PRECAUTIONS

1) Esmolol should be cautiously used in diabetic patients as it can mask the symptoms of hypoglycemia.

2) Esmolol should be avoided in patients with end stage renal disease as the plasma concentrations of esmolol can get elevated in patients with renal disease.

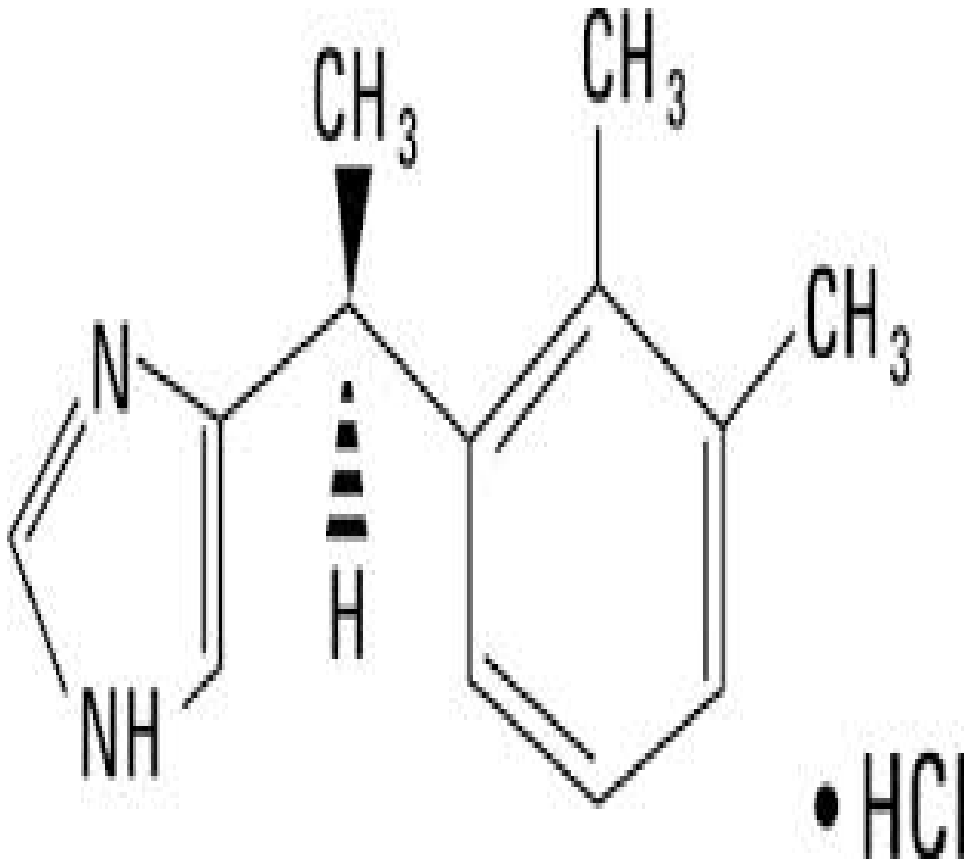
3) Esmolol should be cautiously used in patients with bronchial asthma as bronchospasm can occur.

4) Esmolol should be avoided in pregnancy as fetal bradycardia can occur.

5) Esmolol should be avoided in nursing mothers as esmolol is excreted in breast milk.

PHARMACOLOGY OF DEXMEDETOMIDINE

Dexmedetomidine is a selective alpha-2 agonist which has sedative and analgesic properties.




Precedex
DEXMEDETOMIDINE
HCl INJECTION
Equivalent to
100 mcg/mL
Dexmedetomidine
BASE
IV only
For IV use.

PHARMACODYNAMICS

Dexmedetomidine is selective for alpha 2 receptors but at higher doses it also has alpha 1 action. The sedative properties of dexmedetomidine are mediated through action on post synaptic alpha 2 receptors in locus caerulus in brain and spinal cord. Dexmedetomidine has also action on muscarinic, dopaminergic, adrenergic and serotonin receptors.

PHARMACOKINETICS

Dexmedetomidine has a distribution half life of about 6minutes and a elimination half life of about 2 hours. The volume of distribution is 118 litres and it is highly protein bound .

Metabolism-Dexmedetomidine is predominantly metabolized in the liver into inactive metabolites. Metabolism occurs through glucuronidation and through cytochrome p450 pathways.Context sensitive half life of dexmedetomidine is 4 to 10 minutes.

Elimination

Elimination of dexmedetomidine takes place through the kidneys and hence dexmedetomidine should be cautiously used in patients with severe renal impairment.

INDICATIONS

1. Dexmedetomidine is principally used for sedation of mechanically ventilated patients in the ICU. Dexmedetomidine has the advantage of producing sedation without significant respiratory depression.

2. Dexmedetomidine can also be used for sedation during surgical procedures in monitored anaesthesia care.

3. Dexmedetomidine can be used for rapid opioid detoxification, cocainewithdrawal and intolerance after prolonged use of benzodiazepines and opioids.

4. Dexmedetomidine can also be used in awake fiber optic intubation, awake craniotomies with functional testing and electrocorticography and in awake carotid endarterectomies with stable haemodynamics.

CONTRAINDICATIONS

1. Contraindicated in patients with severe hepatic and renal dysfunction.

2. Patients with known hypersensitivity to dexmedetomidine.

DOSE

Dexmedetomidine is administered at a loading dose of 1microgram/kg followed by infusion at a rate of 0.5 micrograms/ kg/hour.

Infusion dose can be increased by 0.1 microgram/ kg/hour every 5 minutes if adequate clinical response is not obtained. Elderly patients are highly sensitive to dexmedetomidine, Hence the dose of dexmedetomidine should be reduced. Effects of dexmedetomidine can be antagonized by administration of atipamazole.

ADVERSE EFFECTS

The common adverse effects of dexmedetomidine are hypotension, bradycardia, dryness of mouth, hypertension and nausea.

Other adverse effects include fever, arrhythmias like atrial fibrillation,edema, myocardial infarction, pulmonary edema, speech disorders, diarrhoea, hyperkalemia, hyperglycemia, muscle weakness, paraesthesia, delirium, hallucinations, depression, urinary retention, hypoxia, hypercapnia, hypoventilation, pulmonary hypertension, pneumothorax, erythematous rashes and visual disturbances.

Administration of dexmedetomidine is associated with elevation of liver enzymes and decrease in prothrombin levels. Dexmedetomidine canproduce withdrawal syndrome after discontinuation.

DRUG INTERACTIONS

Dexmedetomidine enhances the effects of anaesthetic agents such as hypnotics, sedatives and opioids. Hence, co-administration of these drugs with dexmedetomidine results in decrease in dose requirement of

these agents. Caution should be exercised during administration of dexmedetomidine along with vasodilators and negative inotropic agents as it can worsen bradycardia and hypotension associated with dexmedetomidine. Dexmedetomidine should be avoided in pregnancy and during labour and caesarean section.

Dexmedetomidine should be avoided in nursing mothers as it is excreted in breast milk.

PRECAUTIONS

Close monitoring of the patient with ECG, Pulse oxymeter and Blood pressure monitoring should be done during administration of dexmedetomidine.

Caution should be exercised while administering dexmedetomidine to patients with pre-existing heart block, Congestive cardiac failure and bradycardia.

Patient should be adequately hydrated prior toadministration of dexmedetomidine to prevent hypotension.

Treatment of hypotension includes stoppage of the infusion, elevationof the foot end of the patient and administration of vasopressors.

Administration of loading dose of dexmedetomidine can be associated with transient hypertension. This occurs due to action on alpha 1 receptors in blood vessels due to the high plasma concentration attained during administration of the loading dose.

Rapid intravenous administration of dexmedetomidine to individuals with high vagal tone can cause severe bradycardia and cardiac arrest. Treatment of bradycardia involves administration of anticholinergic agents such as atropine or glycopyrolate.

Administration of dexmedetomidine can cause dryness of eyes and hence patient's eyes should be lubricated to prevent corneal dryness.

Sudden discontinuation of dexmedetomidine after prolonged infusion can cause withdrawal syndrome characterized by rebound hypertension, headache, agitation and nervousness. Henceinfusion of dexmedetomidine should be limited to less than 24 hours.

REVIEW OF LITERATURE

Boezaart et al (1995) in a prospective study of forty patients to compare the effects of sodium nitroprusside and esmolol in controlled hypotension for functional endoscopic sinus surgery. They found that in esmolol group ,due to unopposed alpha adrenergic effect on mucous membrane superior surgical conditions were obtained with mild hypotension(MAP>65 mmhg) when compared with nitroprusside group.

Koi io et al(2009) in a prospective double blinded study of 48 patients to compare the effects of combining desflurane with esmolol and dexmedetomidine in controlled hypotension for tympanoplasty surgery found that both esmolol and dexmedetomidine can be effectively used along with desflurane for tympanoplasty surgery and esmolol group had shorter recovery time and less post operative sedation when compared with dexmedetomidine group.

Turan et al(2007) in a prospective randomized study of patients to compare the effects of dexmedetomidine, remifentanil and esmolol in controlled hypotensive anesthesia found that no significant differences were seen between threegroups with respect to quality of surgical field and intra operative MAP and heart rate but post extubation values were

significantly lower in remifentanil and esmolol group when compared with dexmedetomidine group.

Baysoni et al (2013) in prospective randomized study for comparison of remifentanil and esmolol in induced hypotension for nasal surgery in 30 patients found no significant differences between the two groups with respect to intra operative surgical field and vital parameters like MAP and heart rate and concluded that remifentanil and esmolol provided dry surgical fields during nasal surgery.

Y j lim et al(2003) in a study to compare esmolol with esmolol and normovolemic haemodilution for controlled hypotension in 30 patients undergoing spinal surgery found that transfusion of blood products in esmolol normovolemic haemodilution group was significantly lower when compared with esmolol alone group and concluded that esmolol in combination with normovolemic haemodilution can be effectively used for blood conservation in spinal surgeries.

Celebi et al(2007) in a prospective study of comparison of esmolol and remifentanil on cognitive functions during induced hypotension for tympanoplasty surgeries found that both remifentanil and esmolol provided ideal surgical conditions and they produced

similar effects on cognitive function in the immediate post operative period.

Guney et at(2002) in a prospective study of esmolol compared with nitroglycerine for controlled hypotension in patients undergoing nasal surgeries found that ideal surgical conditions and better heamodynamic stability was provided with esmolol than nitroglycerine. They concluded that esmolol can be effectively used as alternative to nitroglycerine for controlled hypotension.

Eun et al(1997) in a comparative study between sodium nitroprusside and esmolol with induced hypotension for total hip arthroplasty in 70 patients found there were no significant differences between the two groups with respect to blood loss,blood transfusion and fluid administration and concluded that esmolol can be effectively used as an hypotensive agent in hip arthroplasties without significant side effects.

Gokce et al (2009) in prospective randomized double blinded studywith 40 patients of hypotensive anesthesia with esmolol for assessment of haemodynamics and consumption of anesthetic agentsand recovery studied the effects of adding esmolol to propofol and remifentanil combination in controlled hypotension and concluded that

the addition reduced the requirement of remifentanil without decrease in cardiac output.

Kumsuk park et al(2006) in a prospective study of hydralazine pretreatment in patients undergoing controlled hypotensive anesthesia with esmolol in spine surgery found that time required to achieve the target mean arterial pressure was significantly lowered in the group, which had hydralazine pretreatment than esmolol alone group without any decrease in cardiac output and concluded that addition of hydralazine increases the efficacy of esmolol and decreases it's dose requirement without decrease in cardiac output.

Himanshudongre et al(2012) in a study of controlled hypotensive anesthesia comparing esmolol and nitroglycerine in producing a dry operating field for spinal surgery found that the heart rate and mean arterial pressure required for ideal surgical field were significantly lower in esmolol group than nitroglycerine group.

Erbesler et al (2013) in a prospective study compared the effectiveness of dexmedetomidine and esmolol in induced hypotension on clinical course and cost and found that the recovery index and duration of clinical action were significantly prolonged in dexmedetomidine group than esmolol group and concluded that both

drugs can be used in induced hypotension but neuromuscular blocking time was prolonged in dexmedetomidine group.

Mengistu et al (2007) studied the effects of sodium nitroprusside and esmolol used in induced hypotension on natriuretic peptides in 45 patients undergoing endoscopic nasal surgery. Patients were divided into three groups (control, esmolol, nitroprusside group),they found that levels of ANP(atrial natriuretic peptide)and BNP(brain natriuretic peptide) were significantly lower in nitroprusside and esmolol group than control group and concluded that decreasein natriuretic peptide levels were due to decrease in cardiac filling pressures due to decrease in systemic vascular resistance associated with hypotensive anaesthesia.

Zhou qi et al(2010) in a prospective study evaluated the effects of Combining esmolol with nitroglycerine for induced hypotension in Hypertensivepatients undergoing spinal surgery and concluded that the addition of esmolol with nitroglycerine has decreased blood loss in the intraoperative period and the duration of surgery.

Akkaya et al(2014) in a randomized clinical study compared the effects of dexmedetomidine and magnesium sulphate on the quality of surgical field in patients undergoing endoscopic sinus surgery. They found that heart rate and duration of surgery were significantly lower in

dexmedetomidine group, and the quality of surgical field was much better in dexmedetomidine group than magnesium sulphate group. They concluded that dexmedetomidine was a much better alternative to magnesium sulphate for induced hypotension.

Shen et al (2001) in a double blinded randomized control trail,Studied the effects of intra operative esmolol infusion on quality of surgical fields during sevoflurane anesthesia in 40 patients undergoing endoscopic sinus surgery. The patients were divided into two groups ,one received esmolol infusion and other received saline infusion along with inhalational agent sevoflurane. They found that heart rate and blood pressure were significantly lower in esmolol group and thequality ofsurgical field was better in esmolol group. They also found that bloodloss was much lower in esmolol group. They concluded that intra operative infusion of esmolol produced bradycardia and hypotension and the quality of surgical field was significantly improved in patients undergoing endoscopic sinus surgery.

Abdulla aydin ozcan et al (2012) in a randomized prospective study Compared remifentanil and dexmeditomidine for induced hypotension in 50 patients undergoing endoscopic sinus surgery. They found that heart rate was higher in remifentanil group than

dexmedetomidine group and the recovery time was prolonged in dexmedetomidine group than remifentanil group. They concluded that both remifentanil and dexmedetomidine can be effectively used for producing improved qualityof surgical field in patients undergoing endoscopic sinus surgery but dexmedetomidine was associated with prolonged recovery time than remifentanil.

Farah nasreen et al(2009) studied the effects of using dexmedetomidine for controlled hypotension in 42 patients undergoing middle earsurgery.The patients were divided into two groups,one received infusion of dexmedetomidine and other group received saline infusion. The target mean arterial pressure was achieved with halothane.They found that the requirement of halothane to achieve the target mean arterial pressurewas much lower in dexmedetomidine group and surgical field quality was much better in dexmedetomidine group. They concluded that hypotensiveanesthesia can be safely provided in patients undergoing middle ear surgery with dexmedetomidine.

Richaf et al (2008)in a prospective study compared dexmedetomidine with remifentanil in controlled hypotension for patients undergoing tympanoplasty. They concluded that

dexmedetomidine can be safely used as an alternative to remifentanil for providing hypotensive anesthesia in tympanoplasty surgery.

Bayazit dikmen et al(2010)studied the effects of using dexmedetomidine with low flow anesthesia for controlled hypotension in 40 patients undergoing middle ear surgery.The patients were divided into two groups, one received dexmedetomidine infusion and another group received saline infusion. They found that the dexmedetomidine group achieved target mean arterial pressure earlier than saline group.They concluded that dexmedetomidine effectively produced sustained hypotension with low flow anesthesia in patients undergoing middle ear microsurgery.

Malhotra et al(2013)in a prospective study,studied the effects of dexmedetomidine in improving the quality of surgical field and the requirement of hypotensive agents in 60 patients undergoing endoscopic sinus surgery under general anaesthesia. Patients were divided into two groups,one received dexmedetomidine infusion and another received saline infusion and found that nitroglycerine needed to achieve target mean arterial pressure was lower in dexmedetomidine group and mean arterial pressure was significantly lower in dexmedetomidine group. They concluded that better quality surgical

field can be provided with hypotensive anesthesia using dexmedetomidine.

Guang jiegao et al(2012)studied the feasibility of dexmedetomidine for induced hypotension in 48 patients undergoing endoscopic sinus surgery with sevoflurane. The patients were divided into two groups, dexmedetomidine group and saline group. They found that the dose of anesthetic agents like propofol, sevoflurane and fentanyl were significantly lower in dexmedetomidine group ,mean arterial pressure and heart rate were also significantly lower in dexmedetomidine group, incidence of shivering and delirium were also lower in dexmedetomidine group but the incidence of bradycardia was higher in dexmedetomidine group. They concluded that dexmedetomidine provided cardiovascular stability and reduced the intraoperative requirement of anesthetic agents and was effective for hypotensive anesthesia in endoscopic sinus surgery.

Sunil chiruvella et al(2014)made a prospective randomized double blinded study with dexmedetomidine for controlled hypotensive anesthesia in endoscopic sinus surgery.They found that duration of surgery and mean arterial pressure were lower in dexmedetomidine group and the quality of surgical field was better in dexmedetomidine

group. They concluded that dexmedetomidine can be safely used for induced hypotension during endoscopic sinus surgery.

Gurbet et al (2006) studied the effects of intraoperative infusion of dexmedetomidine on perioperative analgesic requirements in 50 patients.Thepatients were divided into two groups,one group received dexmedetomidine infusion and another group received saline infusion .

They found that requirement of morphine in the post operative period was significantly lower in dexmedetomidine group. They concluded that intra operative use of dexmedetomidine provides effective post operative analgesia and reduces analgesic requirement in the post operative period without increasing side effects.

Kim sy et al(2013) studied the effects of intraoperative use of dexmedetomidine infusion on agitation during emergence and recovery quality after nasal surgery in 100 patients. Patients were divided into two groups, one received dexmedetomidine infusion and another received saline infusion. They found that emergence agitation was lower in dexmedetomidine group and heart rate and blood pressure were lower in dexmedetomidine group.24 hours after surgery global –QOR-40 score was higher in dexmedetomidine group. They concluded that intra

operative infusion of dexmedetomidine resulted in better recovery and smooth emergence after nasal surgery.

Guray demir et al(2009) studied the effects of dexmedetomidine on heamodynamic parameters and dose of propofol during anesthetic induction in 80 patients. Patients were divided into two groups, one group received dexmedetomidine and another group received saline. They found that mean arterial pressure and heart rate were significantly lower in dexmedetomidine group, the dose of propofol was also lower in dexmedetomidine group. They concluded the use of propofol before induction blunted heamodynamic response associated with laryngoscopy and intubation,it also reduced the requirement of propofol.

MATERIALS & METHODS

The study was a prospective randomized single blinded control trial involving 50 patients (25 in each group) attending the Department of Ear, nose and Throat, Chengalpattu Medical College Hospital over a period of one year(July 2013 – June 2014). Institutional ethical committee approval was obtained. The procedure was explained to the patient. Informed consent was obtained. Detailed history of the patient was collected. Routine investigations like complete blood count, blood glucose, renal function tests, serum electrolytes, chest x ray, electrocardiogram were done as per our hospital protocol. Patients fulfilling the inclusion criteria and who gave consent were then randomly allocated to one of the study groups on the basis of computerized randomized list.

Inclusion Criteria:

1. ASA 1
2. Age: 20-50 years
3. Patients posted for Elective FESS

Exclusion Criteria

1. Patients with coronary artery disease
2. Patients with diabetes
3. Patients with Hypertension
4. Patients with renal dysfunction
5. Patients with Hepatic Dysfunction
6. Patients with Bleeding Diathesis,
7. Patients with Cerebrovascular disease
8. Patients with Recurrent sinus surgery

Materials Needed

1. 18G iv Cannula
2. 18G radial artery cannula
3. 50cc Syringe
4. Infusion Pump
5. Transducer
6. 2cc, 5cc and 10cc Syringes
7. Injection Dexmedetomidine

8. Injection Esmolol
9. Boyle's Apparatus
10. Working laryngoscope, cuffed endotracheal tubes of appropriate size, Airway, suction apparatus with suction catheter.
11. Emergency drugs like Inj. Adrenaline, Inj. Atropine, Inj. Ephedrine.
12. Monitor for continuous monitoring of Invasive blood pressure, ECG,Respiratory rate, Oxygen saturation.

Methodology

18 G iv Cannula was inserted and the patients started on infusion Ringer Lactate. Another 18G iv Cannula was inserted in the opposite limb for infusion of the Study drug.

18 G radial Artery Cannula was inserted for continuous measurement of Arterial Blood Pressure.

All patients were premedicated with Injection Glycopyrolate 0.2mgintramuscularly 45 minutes prior to surgery, Injection Midazolam 0.05 mg/kg intravenously and Injection Fentanyl 2 microgram/kg intravenously.

In Esmolol group, patients were given a loading dose of Esmolol at 1mg/kg over 1 minute followed by infusion at the rate of 0.4-0.8 mg/kg/hour before induction. The infusion dose was titrated to obtain a mean arterial pressure between 55-65 mm Hg.

In Dexmedetomidine group, patients were given a loading dose Of dexmedetomidine at 1 microgram/kg diluted in 10 mL of 0.9 % Saline over 10 minutes followed by infusion at the rate 0.4-0.8 micrograms/kg/hour before induction. The infusion dose was titrated to obtain a mean arterial pressure between 55-65 mm Hg.

Induction agent used in all patients in this study was Propofol. Propofol was administered at a dose of 1-2mg/kg until the loss of Verbal response. Induction dose of Propofol was recorded.

Intubation was done following administration of Injection Atracurium0.5 mg/kg with appropriate sized Endotracheal Tubes. Anaesthesia was maintained with 60 % N_2O/O_2 mixture.

All patients were placed in 15 degree reverse Trendelenberg position and their nasal cavities were packed with Cottonoids, soaked with Epinephrine in a concentration of 1: 80,000.

All the surgeries were performed by the same Surgeon, who was blinded to the hypotensive agent used, so as to ensure consistency in estimating the quality of the surgical field.

Infusion of the study drugs was stopped 10 minutes before the end of the surgery. Patients were extubated after reversal with inj neostigmine and inj glycopyrolate.

Parameters Monitored

1. **Dose of Propofol**
2. **Blood Pressure**- Pre-operatively, After induction, at 15 minutes, at 30 minutes, at 45 minutes during surgery, 5 minutes after stoppage of infusion of study drug, 10 minutes after stoppage of infusion of study drug, at the end of surgery, after extubation.
3. **Heart rate -** Pre-operatively, After induction, at 15 minutes, at 30 minutes, at 45 minutes during surgery, 5 minutes after stoppage of infusion of study drug, 10 minutes after stoppage of infusion of study drug, at the end of surgery, after extubation.

4. **Serum cortisol level intraoperatively**

5. **Emergence Time:** It is the time interval between stoppage of the anaesthetic drugs and eye-opening to oral commands.

6. **Quality of the surgical field**- It is assessed using average category scale.

Average Category Scale

Score 0	-	No bleeding
Score 1	-	Minimal Bleeding, suctioning not required
Score 2	-	Minimal Bleeding, suctioning occasionally required
Score 3	-	Minimal Bleeding, repeated suctioning required
Score4	-	Moderate Bleeding, repeated suctioning required, bleeding obscures surgical field
Score 5	-	Severe Bleeding, surgery not possible as bleeding completely obscures the surgical field

7. **PostAnaesthesia Recovery Score**: it is assessed using **Modified Aldrete Score.**

1. **Activity**- Able to move voluntarily or on command

Four extremities	2
Two extremities	1

No extremities 0

2. **Respiration**

Able to breathe deeply and cough freely 2

Dyspnea, shallow or limited breathing 1

Apnea 0

3. **Circulation**

Blood pressure within 20 mm Hg of Pre-Op level 2

Blood Pressure within 20-50 mm Hg of Pre-Op level 1

Blood Pressure ± 50 mm Hg of Pre-Op level 0

4. **Consciousness**

Fully Awake 2

Arousable on command 1

unresponsive 0

5. **Oxygen saturation**

Saturation more than 92 % 2

Needs Oxygen to maintain saturation more than 90 % 1

Saturation less than 90 % with oxygen 0

Total Score- 15

9 or more points are required for recovery to be confirmed.

Time required to attain Modified Aldrete Score of more than 9 is recorded.

8. **Sedation Score** at 15, 30 and 60 minutes after extubation is recorded.

Sedation Score- Ramsay Sedation Score

Score 1 Patient is anxious, agitated or restless or both

Score 2 Patient is cooperative, oriented and tranquil

Score 3 Patient responds to commands only

Score 4 Patient exhibits brisk response to light, glabellar tap or loud auditory stimulus

Score 5 Patient exhibits sluggish response to light, glabellar tap or loud auditory stimulus

Score 6 Patient exhibits no response

9. The time required for first rescue analgesic in the post-operative period is also recorded.

STATISTICAL ANALYSIS

Dose of propofol, heart rate, systolic blood pressure, diastolic blood pressure, emergence time, post anaesthesia recovery score, sedation score, time for rescue analgesia. All recorded data wee entered using MS-excel software and analysed using SPSS(Statistical Package of Social Sciences, Version 16 for windows, student's t-test was used to compare the two groups on mean values of various parameters. The p-value taken for significance is <0.05.

RESULTS AND OBSERVATION

Our study included 50 patients,patients were randomly allocated into either group E(esmolol group) or group D(dexmetetomidine).Initial patient charecteristics such as age, weight and ASA grading were noted.

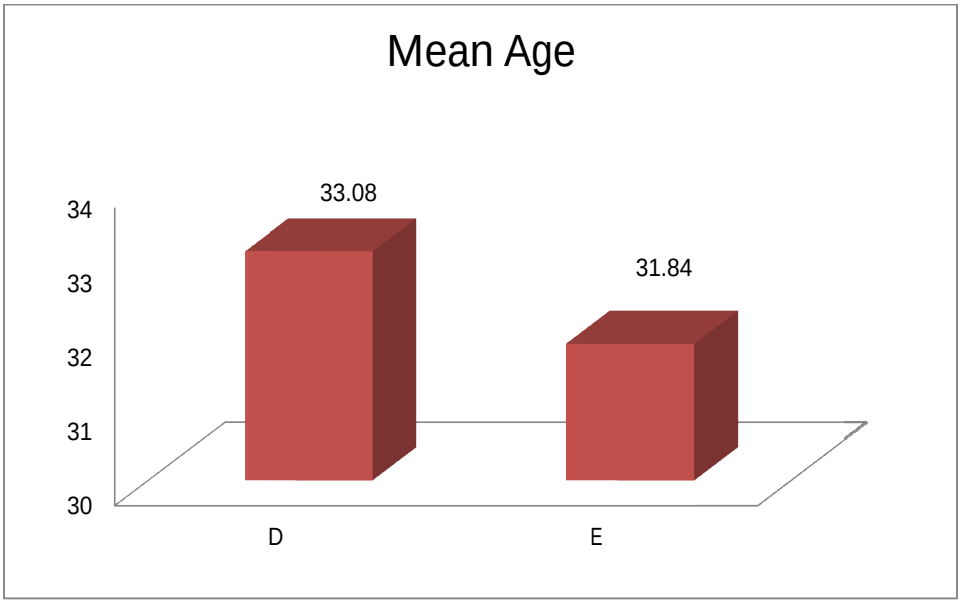
Outcomes measured are dose of propofol, heart rate and blood pressure,quality of surgical field, emergence time, post anesthesia recovery score,sedation score at 15 minutes,30 minutes and 60 minutes after surgery,time for rescue analgesia post operatively, serum cortisol intraoperatively.

PATIENT CHARECTERISTICS

AGE(student's t test)

The average age did not differ between the two groups. The mean age in group E was 31.84±8.68 years and that of group D was33.08±7.39. The difference was not statistically significant(p value =0.5).

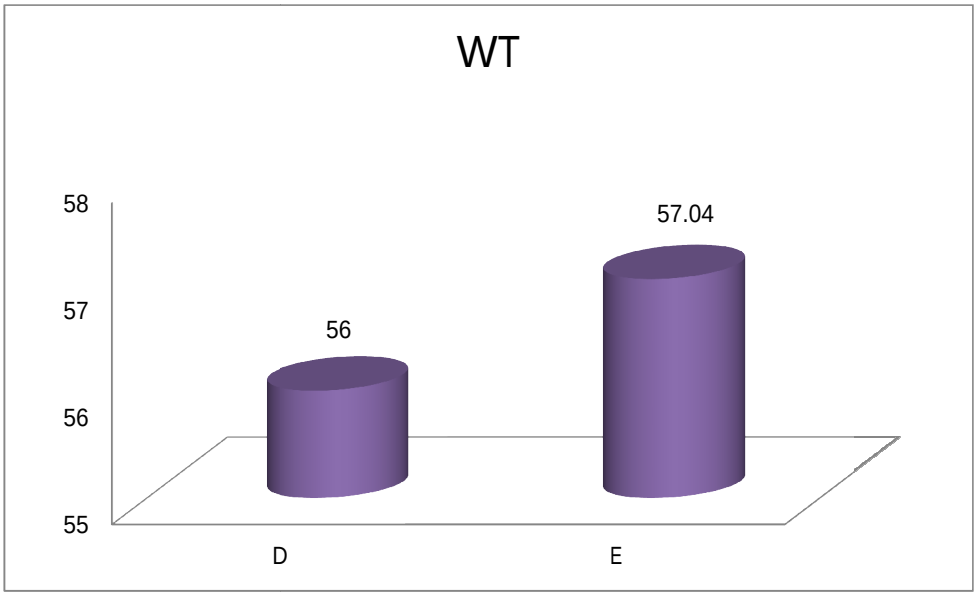
Group	Mean	T value	P value
Group D	33.08±7.3	0.543	0.5
Group E	31.84±8.6		



WEIGHT(student's t test)

The average weight did not differ between the two groups. The average weight of patients in group Ewas 57.04±9.74 and the average weight of patients in group D was 56±9.12.The differences was not statistically significant(p value=0.7).

Group	mean	T value	P value
Group D	56±9.1	0.389	0.7
Group E	57.04±9.7		

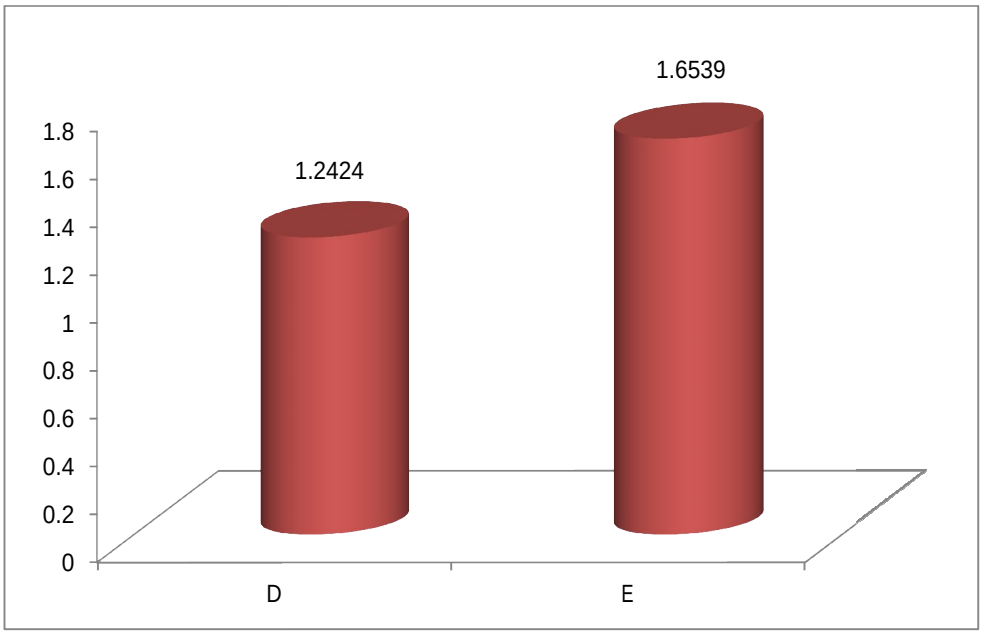


OUTCOMES MEASURED

1) Dose of propofol(student's t test)

The inductiondose of propofol was lower in group D(1.24±0.10 mg/kg) when compared with group E(1.65±0.13 mg/kg),which was statistically significant (p value<0.001).

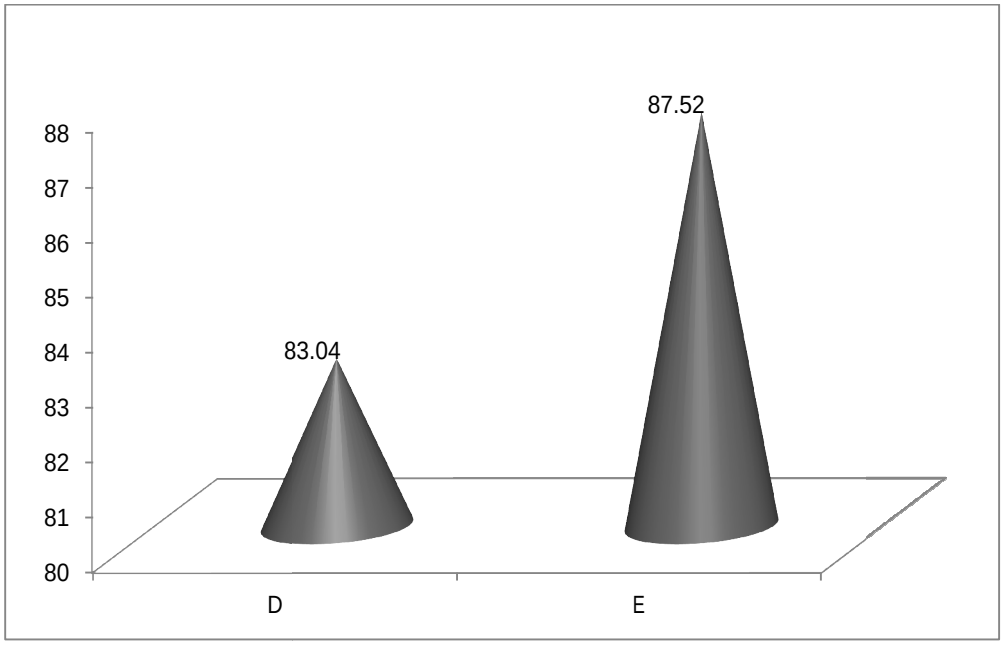
Group	mean	T value	P value
Group D	1.24±0.10	12.20	0.00
Group E	1.65±0.13		



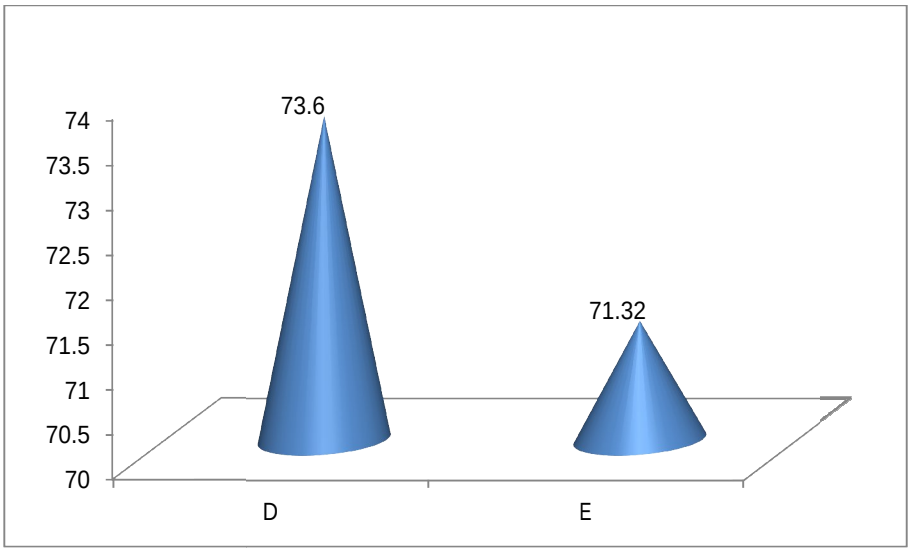
2) HEART RATE(student's t test)

Heart rates were compared between two groups preoperatively, after induction,at(15 minutes,30 minutes,45 minutes)during surgery,at(5 minutes and 10 minutes after stoppage of study drug), at end of surgery,after extubation.

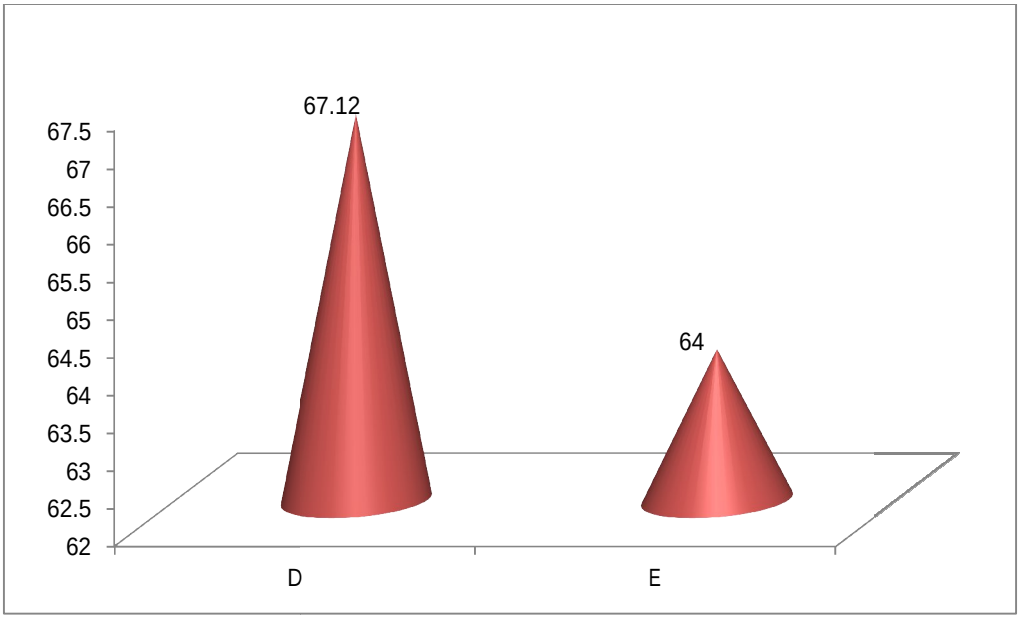
Comparison showed no statistically significant differences in heart rate between two groups preoperatively(p value=0.058)



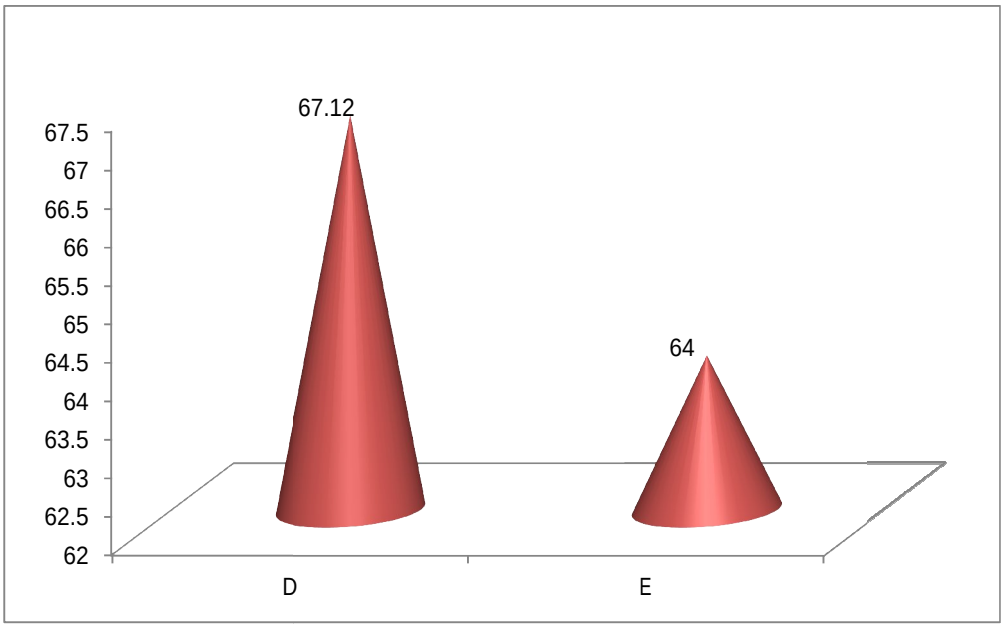
Comparison showed no statistically significant differences in heart rate between two groups after intubation(p value=0.27).



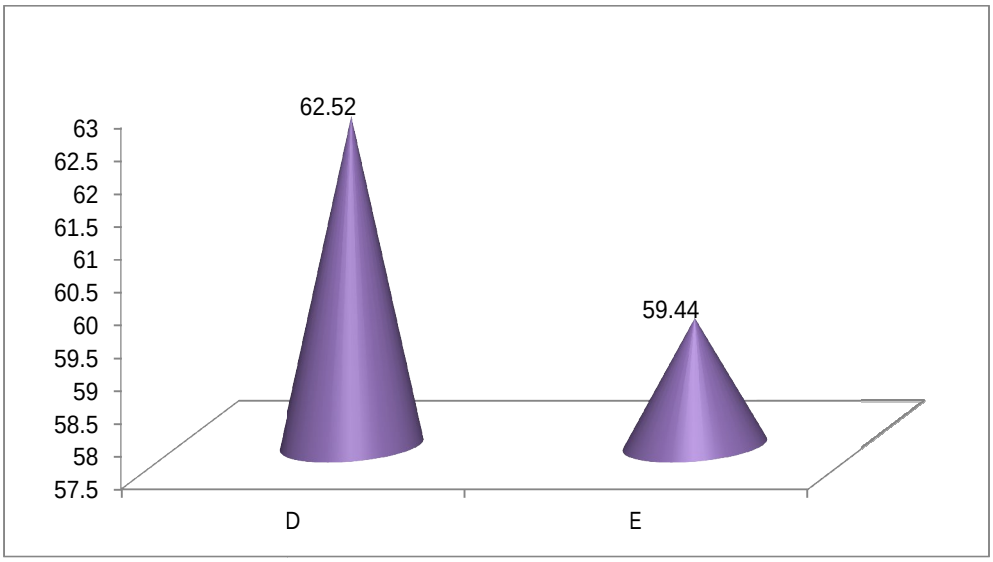
Comparison showed no statistically significant differences in heartrate between two groups at 15 minutes during surgery (pvalue=0.082)



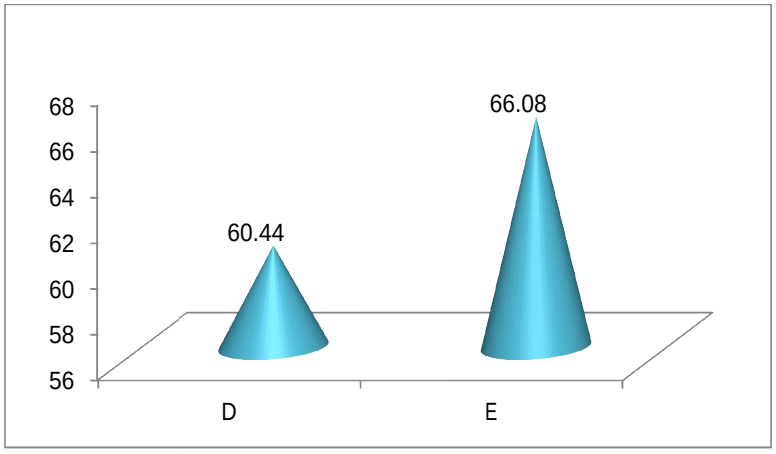
Comparison showed no statistically significant differences in heart rate between two groups at 30 minutes during surgery(pvalue=0.05)



Comparison showed no statistically significant differences in heart rate between two groups at 45 minutes during surgery(p value=0.09).

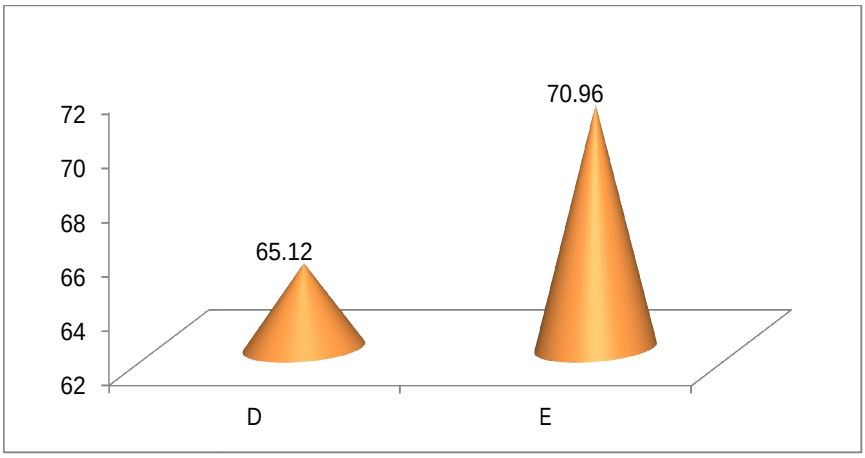


Comparison showed statistically significant differences in heart rate between two groups at 5 minutes after stoppage of study drug (p value<0.001).Heart rate's were significantly higher in group E than group D.

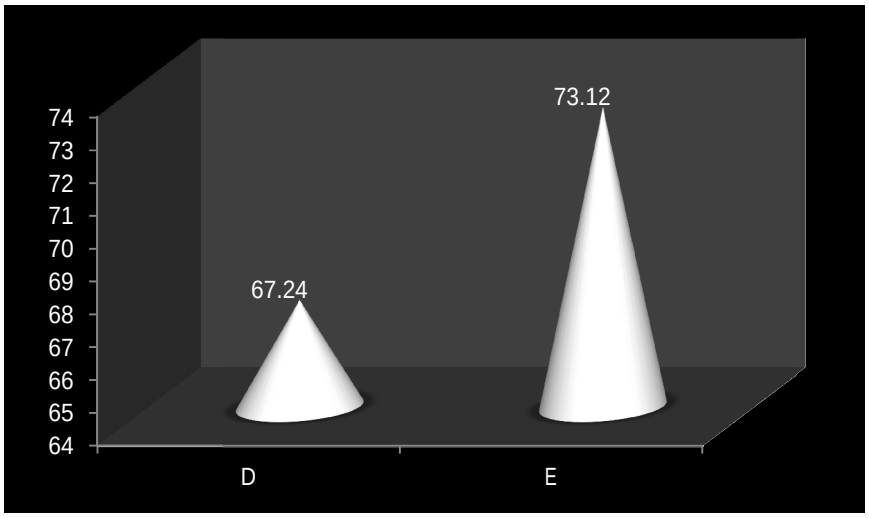


Comparison showed statistically significant differences in heart rate between two groups at 10 minutes after stoppage of study drug

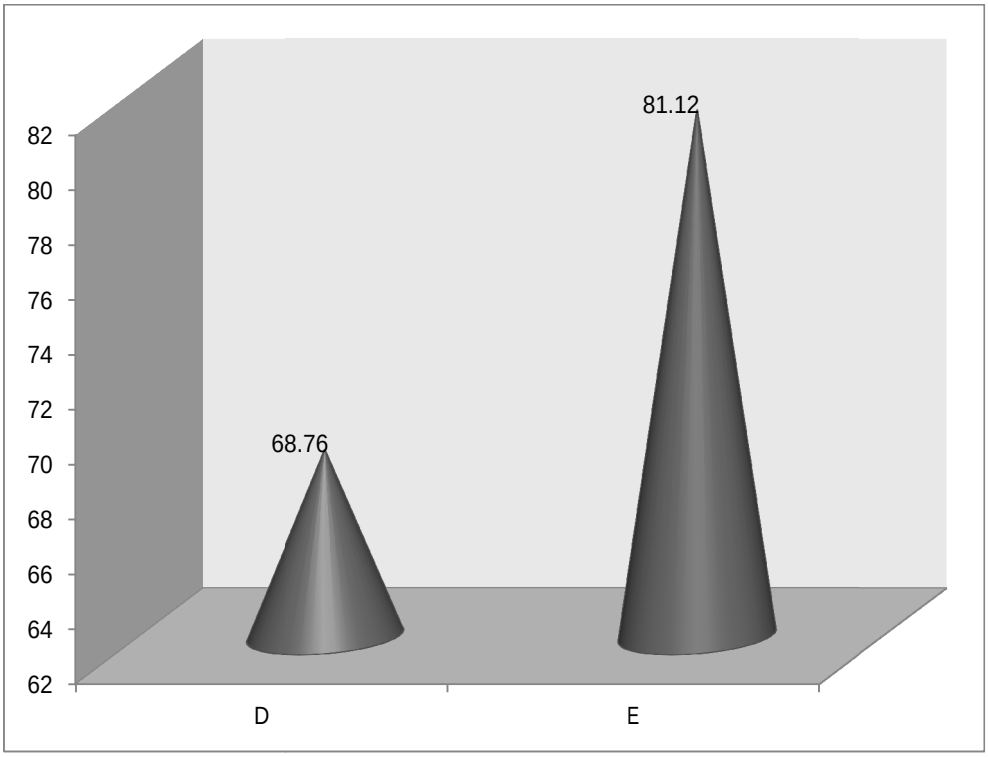
(p value=0.002).Heart rate's were significantly higher in group E than group D.



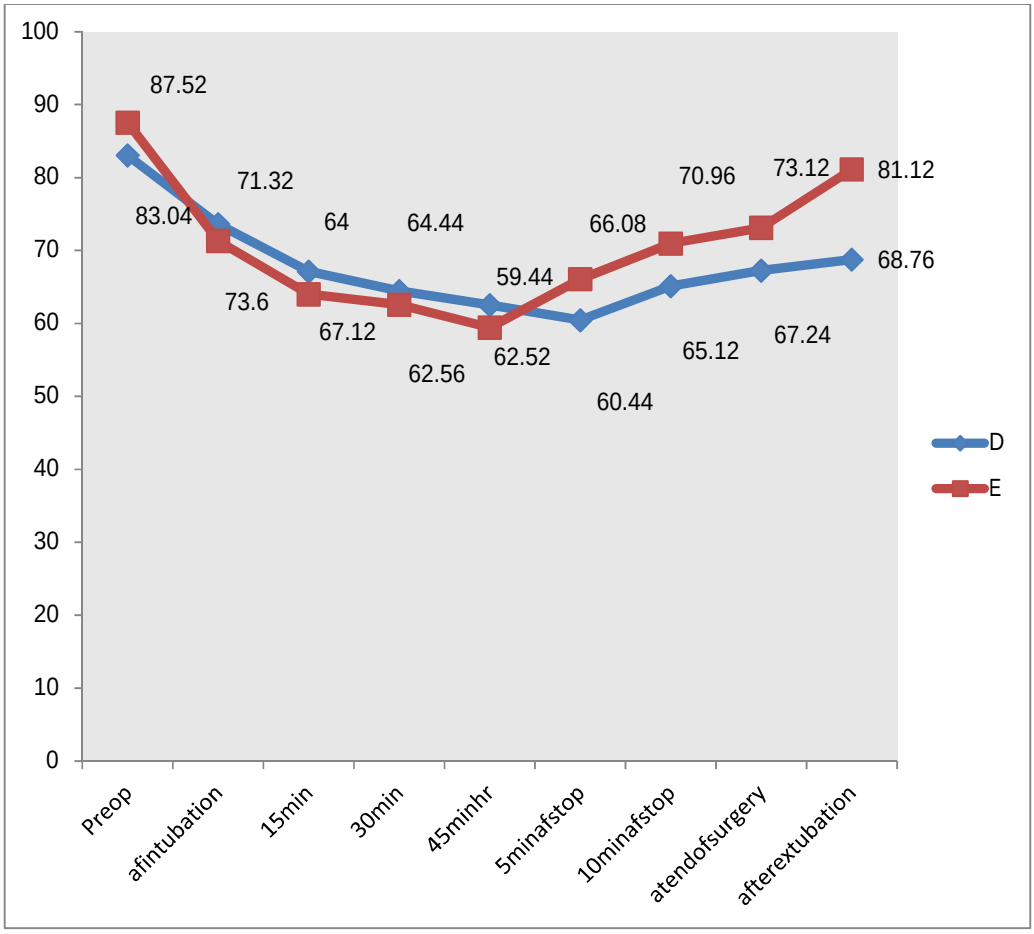
Comparison showed statistically significant differences in heart rate between two groups at end of surgery(p value=0.002).Heart rate's were significantly higher in group E than group D.



Comparison showed statistically significant differences in heart rate between two groups at end of surgery(p value<0.001).Heart rate's were significantly higher in group E than group D.



Time	Group	Mean	T value	p value
Pre operative	D	83.04±8.1	1.944	0.058
	E	87.52±8.1		
After intubation	D	73.6±6.8	1.117	0.27
	E	71.32±7.5		
15 min of surgery	D	67.12±5.7	1.777	0.082
	E	64±6.6		
30 min of surgery	D	64.44±8.5	2.34	0.05
	E	62.56±6.1		
45 min of surgery	D	62.52±6.0	1.732	0.09
	E	54.44±6.5		
5 min after stoppage	D	60.44±6.7	3	0.00
	E	66.08±6.5		
10 min after stoppage	D	65.12±5.8	3.284	0.002
	E	70.96±6.6		
At end of surgery	D	67.27±5.7	3.351	0.002
	E	73.12±6.6		
After extubation	D	68.76±5.3	7.576	0.00
	E	81.12±6.1		


100
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80
70
60
50
40
30
20
10
0
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83.04
71.32
64
64.44
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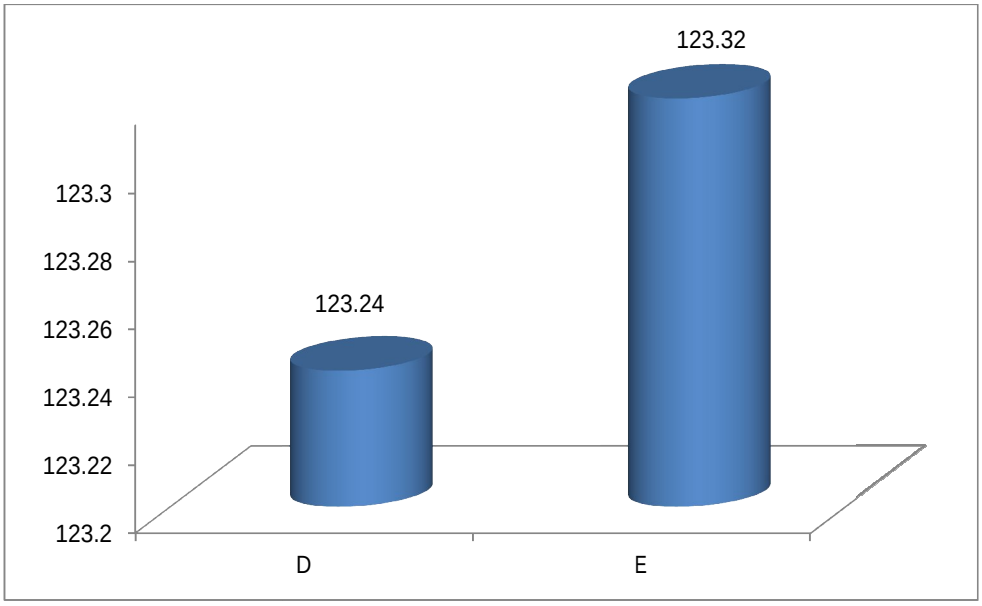
66.08
70.96
73.12
81.12
68.76
73.6
67.12
62.56
62.52
60.44
65.12
67.24
Preop
afintubation
15min
30min
45minhr
5minafstop
10minafstop
atendofsurgery
afterextubation
D
E

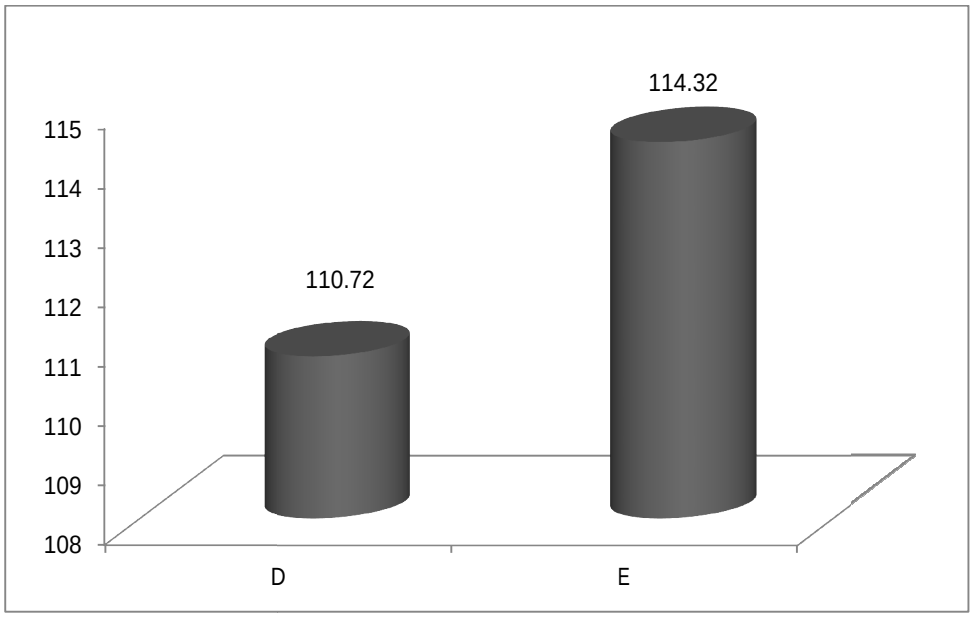
3. COMPARISON OF SYSTOLIC BLOOD PRESSURE(student's t test)

Systolic blood pressure was compared between two groups preoperatively,after induction, at(15 minutes,30 minutes,45 minutes) during surgery,at(5 minutes and 10 minutes after stoppage of study drug), at end of surgery, after extubation.

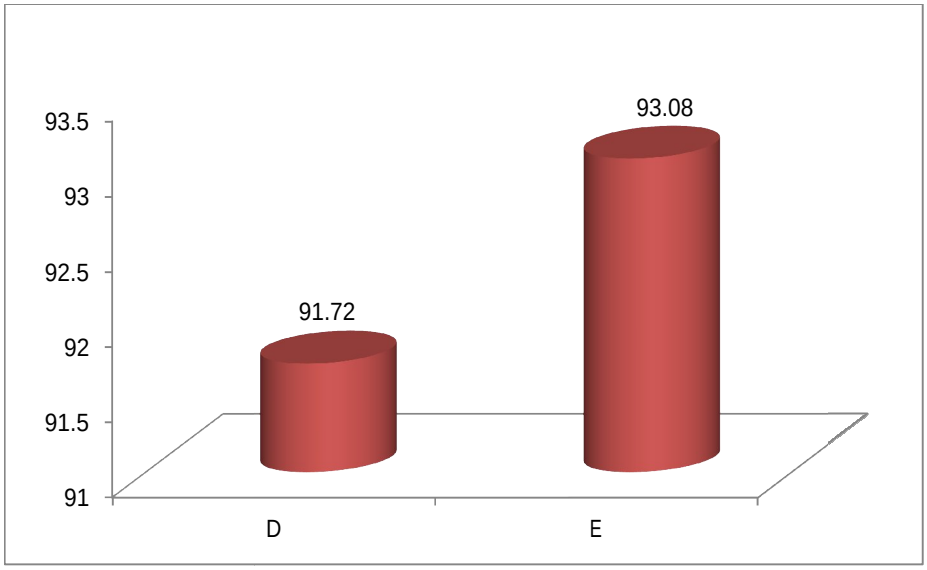
Comparison showed no statistically significant differences in systolic blood pressure between two groups pre operatively (p value=0.98)



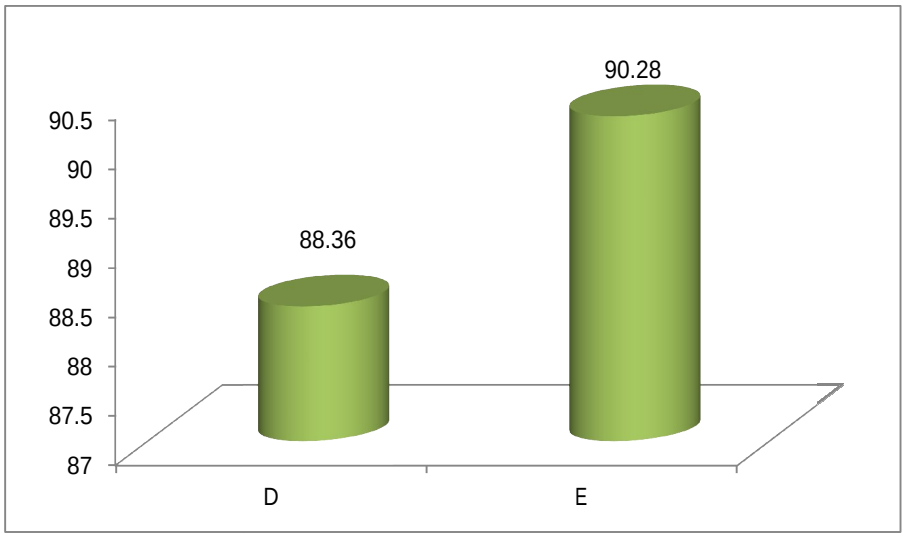
Comparison showed no statistically significant differences in systolic blood pressure between two groups after intubation (p value=0.06).



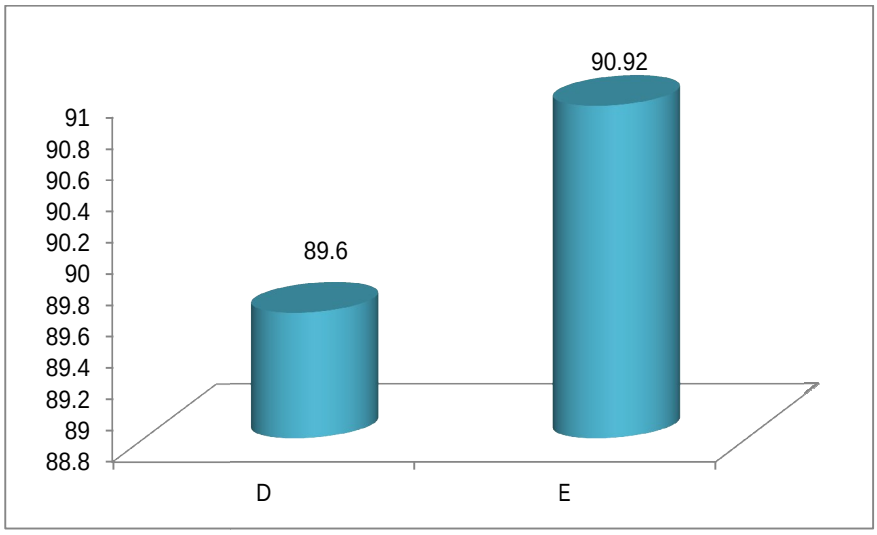
Comparison showed no statistically significant differences in systolic blood pressure between two groups at 15 minutes during surgery (p value=0.05).



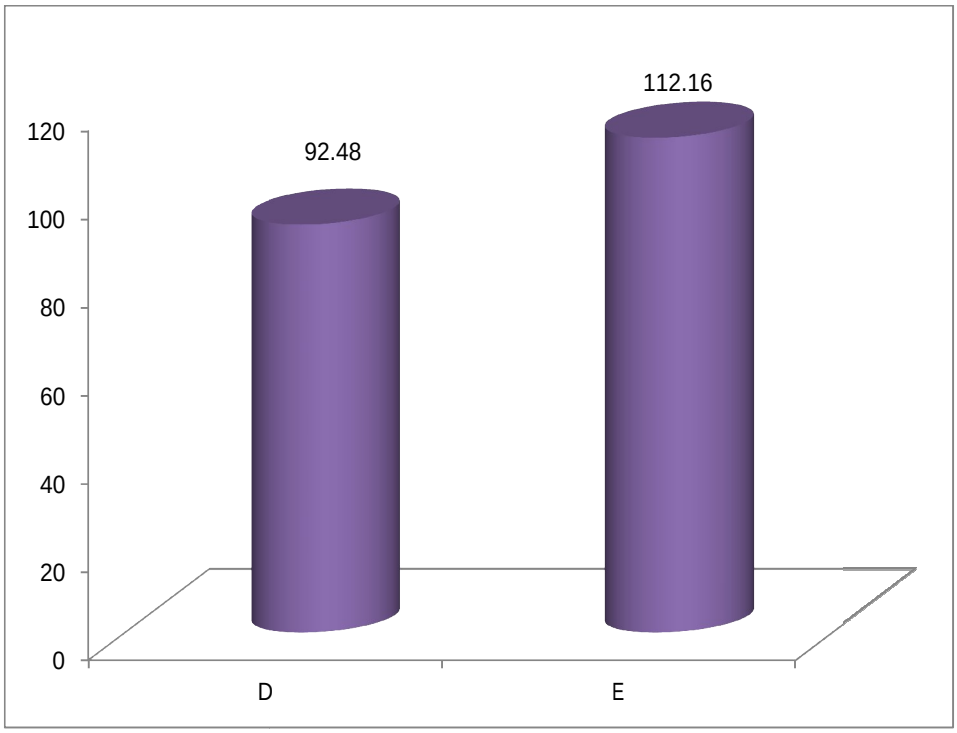
Comparison showed no statistically significant differences in systolic blood pressure between two groups at 30 minutes during surgery (p value=0.08).



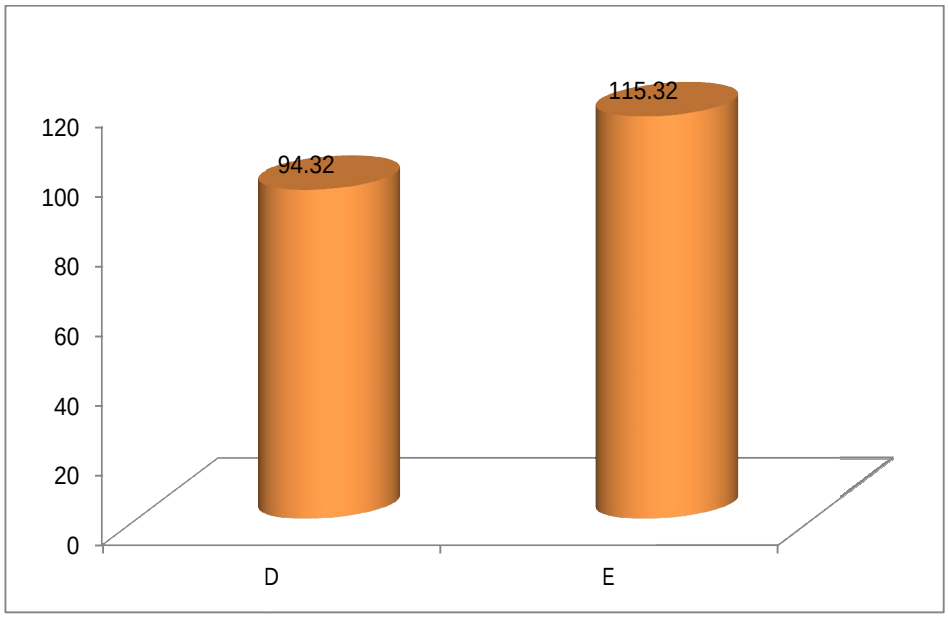
Comparison showed no statistically significant differences in systolic blood pressure between two groups at 45 minutes during surgery (p value=0.17).



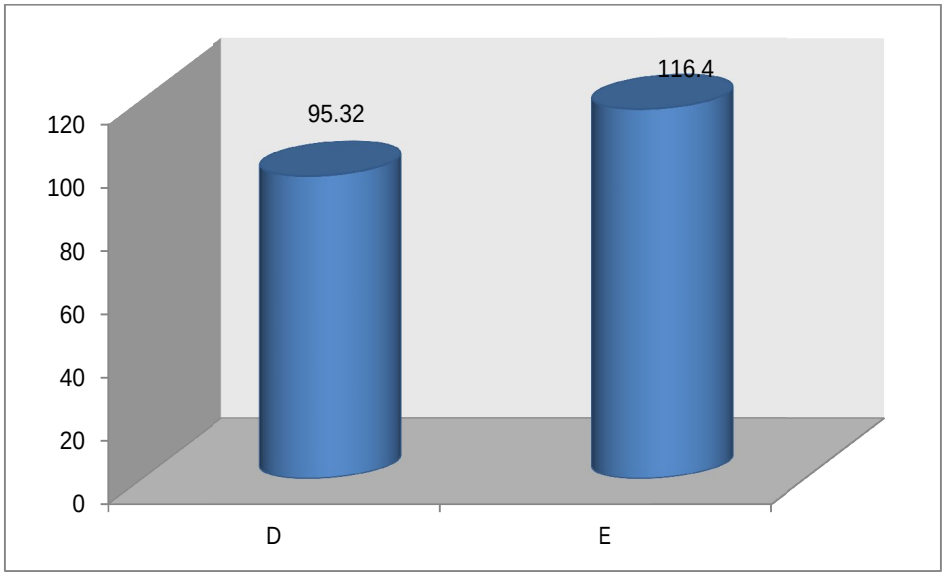
Comparison showed statistically significant differences in systolic blood pressure between two groups at 5 minutes after stoppage of study drug.Systolic blood pressure was significantly higher in group E than group G (p value<0.001).



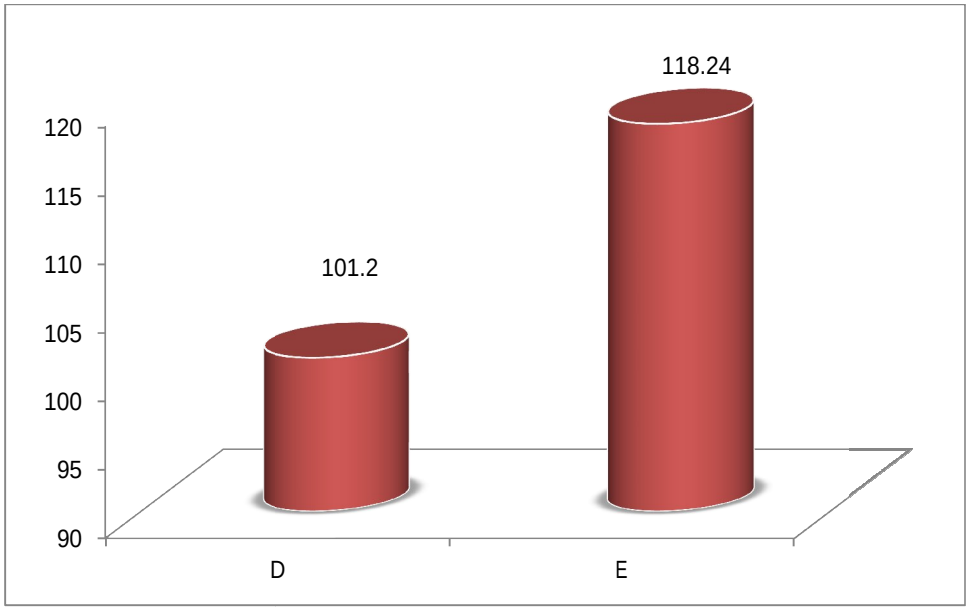
Comparison showed statistically significant differences in systolic blood pressure between two groups at 10 minutes after stoppage of study drug. Systolic blood pressure was significantly higher in group E than group G (p value<0.001).



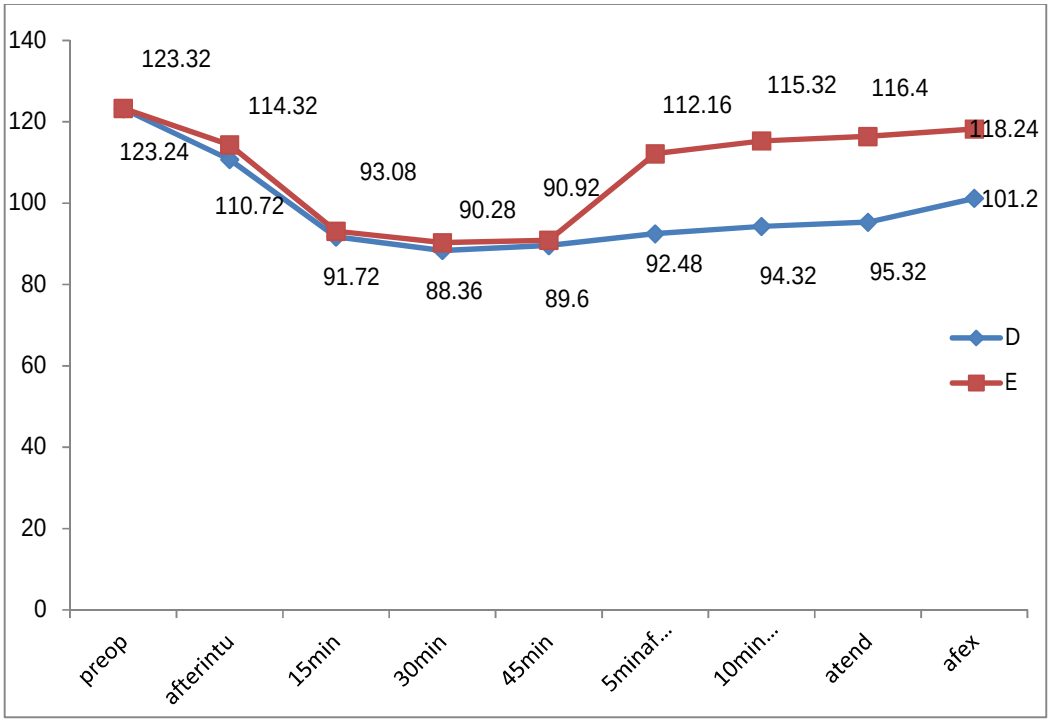
Comparison showed statistically significant differences in systolic blood pressure between two groups at end of surgery.Systolic blood pressure was significantly higher in group E than group G (p value<0.001).



Comparison showed statistically significant differences in systolic blood pressure between two groups after extubation. Systolic blood pressure was significantly higher in group E than group G (p value<0.001).



Time	Group	Mean	T value	P value
Pre operatively	D	123.24±10.8	0.03	0.98
	E	123.32±7.6		
After intubation	D	110.72±5.5	1.92	0.06
	E	114.32±6.7		
15 min of surgery	D	91.72±4.9	1.91	0.05
	E	93.08±5.5		
30 min of surgery	D	88.36±3.5	1.813	0.08
	E	90.28±3.8		
45 min of surgery	D	89.6±2.9	1.407	0.17
	E	90.92±3.6		
5 min after stoppage	D	92.48±2.6	14.54	0.00
	E	112.16±6.1		
10 min after stoppage	D	94.32±2.8	16.69	0.00
	E	115.32±5.6		
At end of surgery	D	95.32±3.0	15.65	0.00
	E	116.4±5.4		
After extubation	D	101.2±3.7	11.53	0.00
	E	118.24±6.3		


140
120
100
80
60
40
20
0
123.32
114.32
93.08
90.28
90.92
112.16
115.32
116.4
118.24
123.24
110.72
91.72
88.36
89.6
92.48
94.32
95.32
101.2
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10min...
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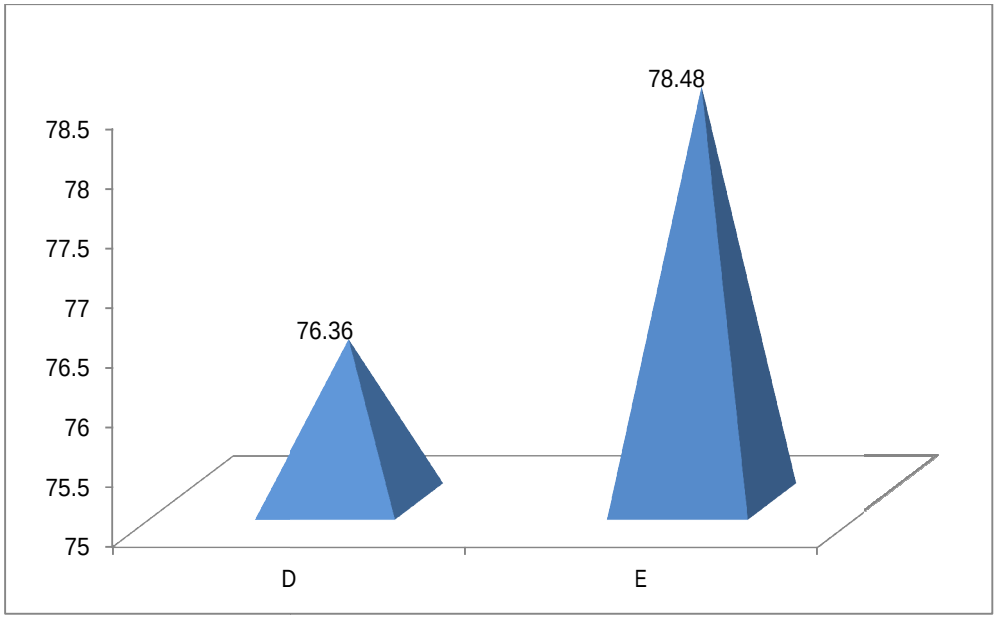
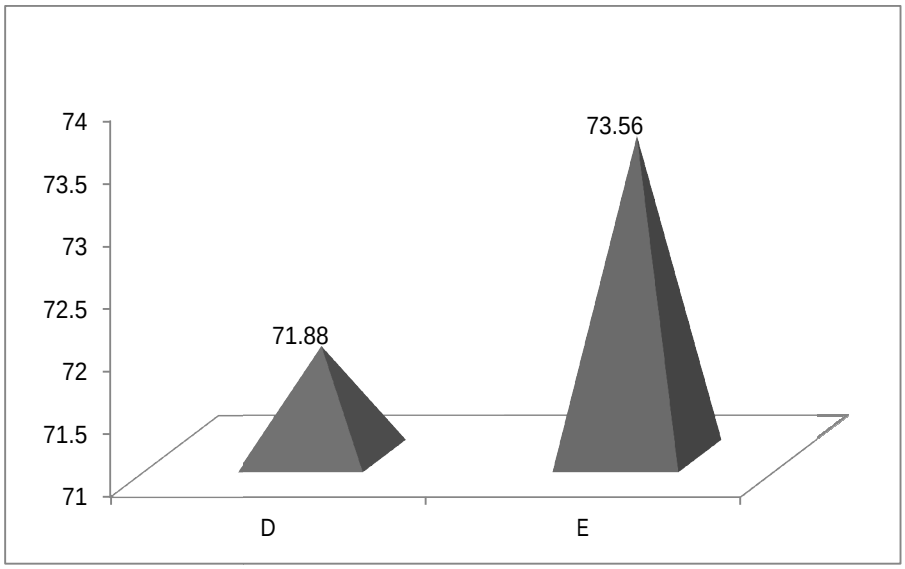
COMPARISON OF DIASTOLIC BLOOD PRESSURE(student's t test)

Diastolic blood pressure was compared between two groups preoperatively, after induction, at(15 minutes,30 minutes,45 minutes) during surgery, at(5 minutes and 10 minutes after stoppage of study drug), at end of surgery, after extubation.

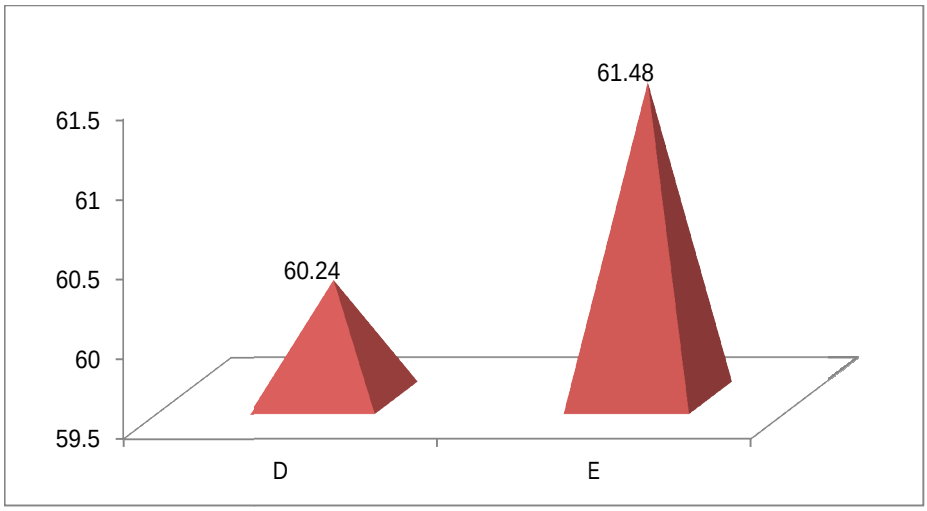
Comparison showed no statistically significant differences in diastolic blood pressure between two groups pre operatively (p value=0.27).



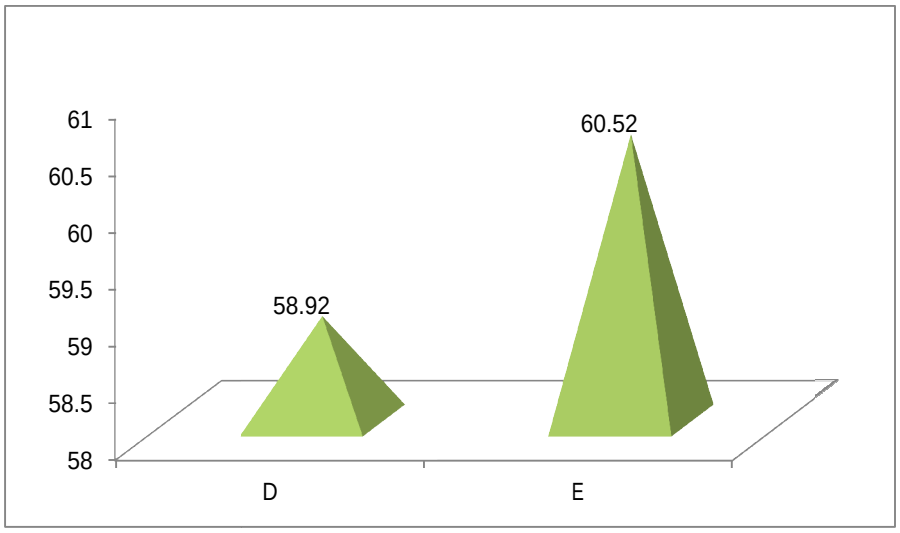
Comparison showed no statistically significant differences in diastolic blood pressure between two groups after intubation (p value=0.31).



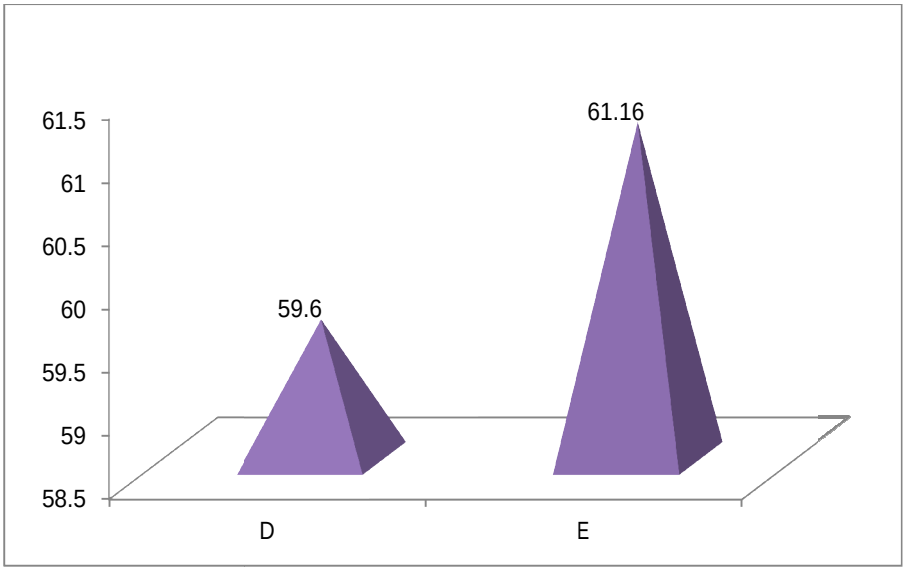
Comparison showed no statistically significant differences in diastolic blood pressure between two groups at 15 minutes during surgery (p value=0.54).



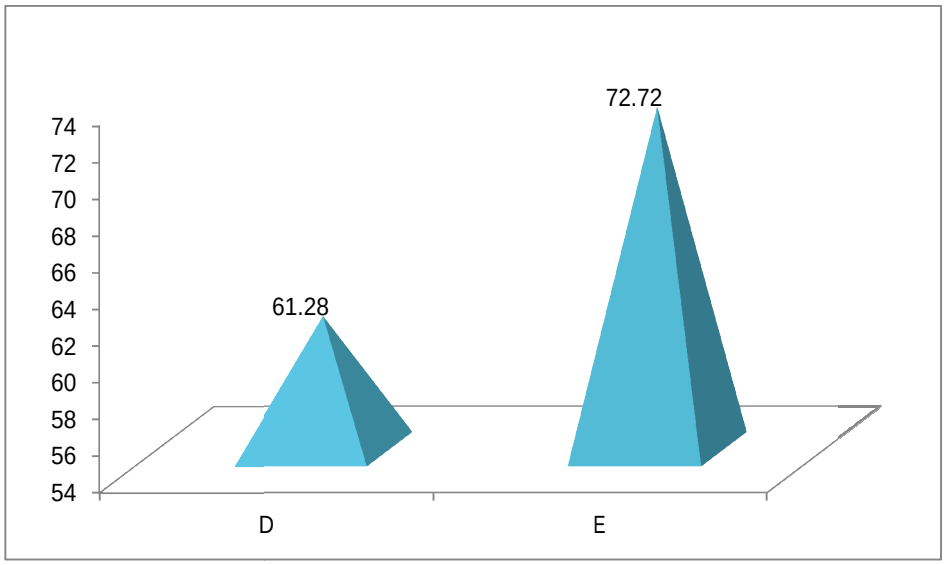
Comparison showed no statistically significant differences in diastolic blood pressure between two groups at 30 minutes during surgery (p value=0.15).



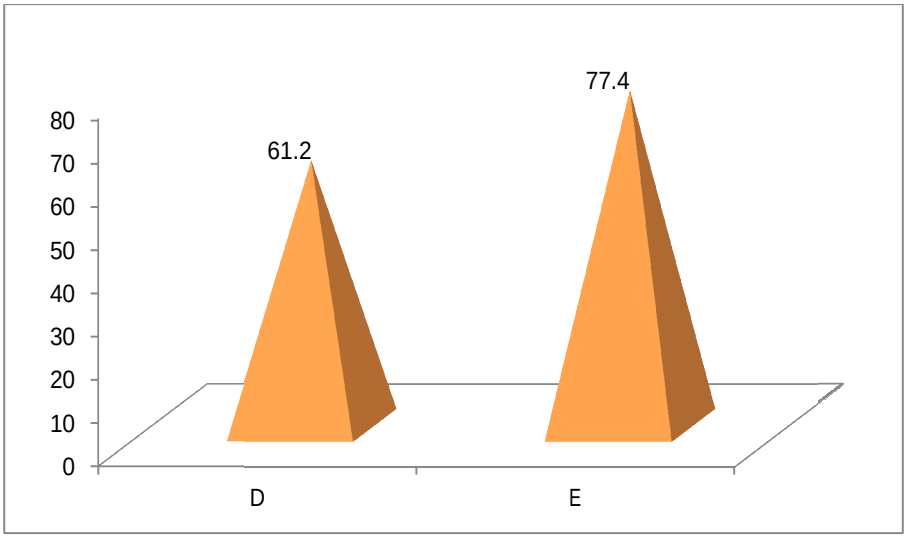
Comparison showed no statistically significant differences in diastolic blood pressure between two groups at 45 minutes during surgery (p value=0.19).



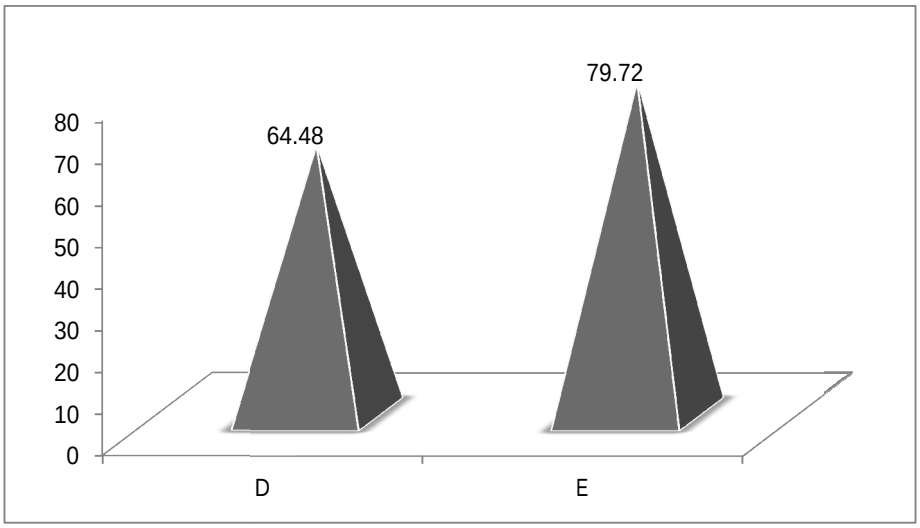
Comparison showed statistically significant differences in diastolic blood pressure between two groups at 5 minutes after stoppage of study drug .diastolic blood pressure was significantly higher in group E than group G (p value<0.001).



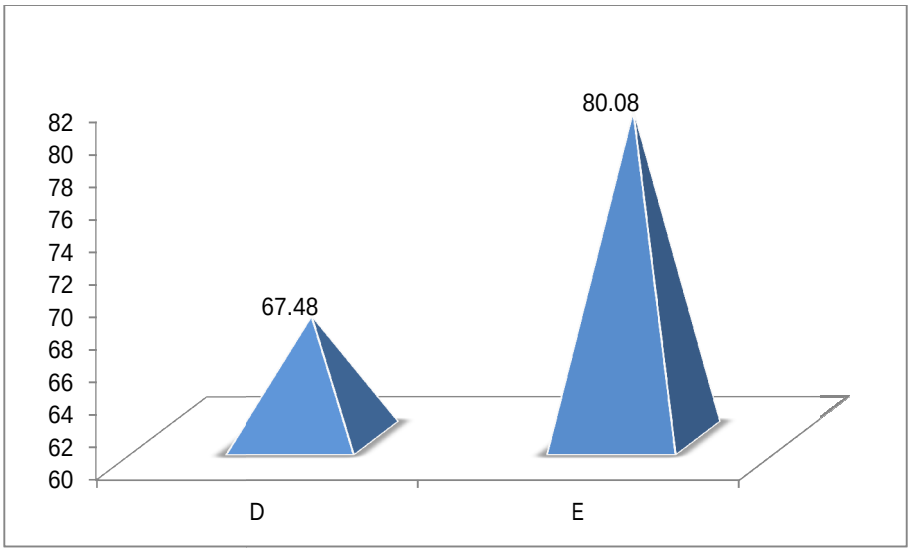
Comparison showed statistically significant differences in diastolic blood pressure between two groups at 10 minutes after stoppage of study drug .diastolic blood pressure was significantly higher in group E than group G (p value<0.001).



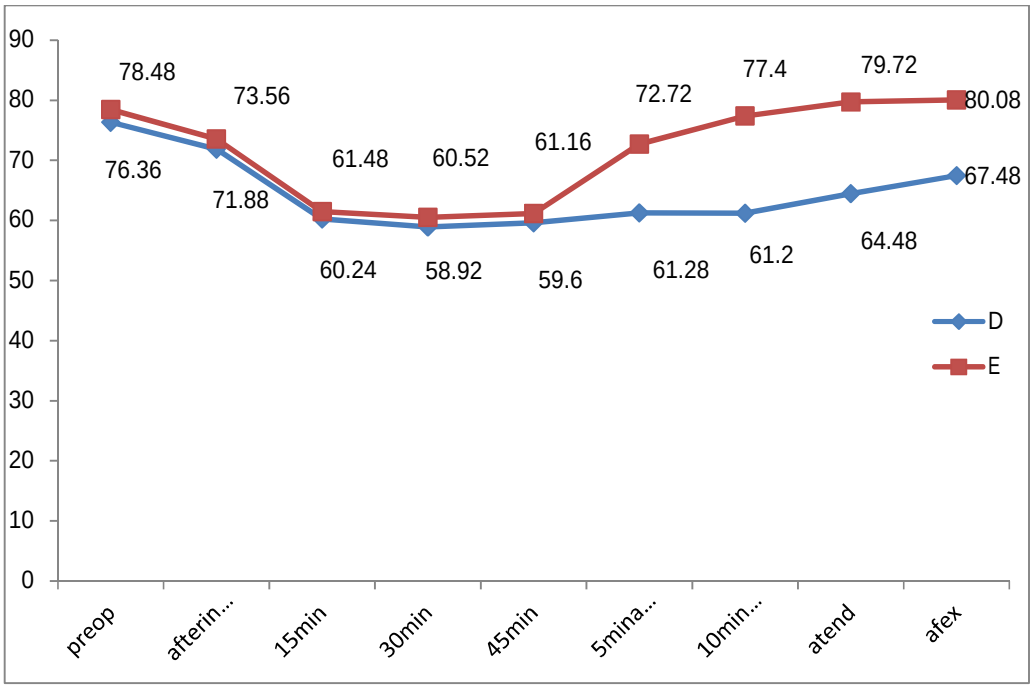
Comparison showed statistically significant differences in diastolic blood pressure between two groups at end of surgery .diastolic blood pressure was significantly higher in group E than group G (p value<0.001).



Comparison showed statistically significant differences in diastolic blood pressure between two groups after extubation .Diastolic blood pressure was significantly higher in group E than group G (p value<0.001).



Time	Group	mean	T value	P value
Pre op	D	76.36±6.5	1.118	0.27
	E	78.48±6.8		
After intubation	D	71.88±5.9	1.023	0.31
	E	73.56±5.6		
15 min of surgery	D	60.24±5.5	0.624	0.54
	E	61.48±8.2		
30 min of surgery	D	58.92±3.7	1.452	0.15
	E	60.52±4.0		
45 min of surgery	D	59.6±4.5	1.345	0.19
	E	61.16±3.5		
5 min after stoppage	D	61.28±4.1	7.624	0.00
	E	72.72±6.6		
10 min after stoppage	D	61.2±4.0	12.041	0.00
	E	77.4±5.3		
At end of surgery	D	64.48±3.3	12.604	0.00
	E	79.72±5.0		
After extubation	D	67.48±3.7	11.05	0.00
	E	80.08±4.3		


90
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78.48
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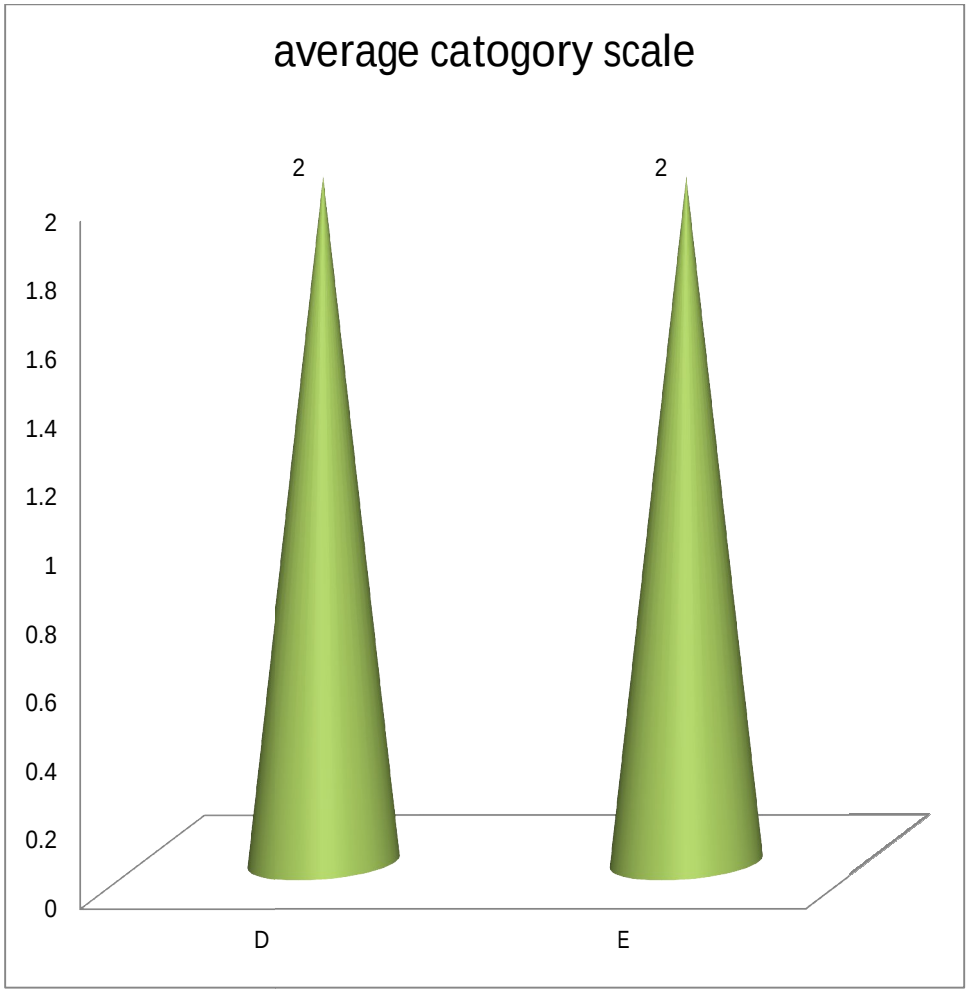
4) QUALITY OF SURGICAL FIELD-AVERAGE CATEGORY SCALE(student's t test)

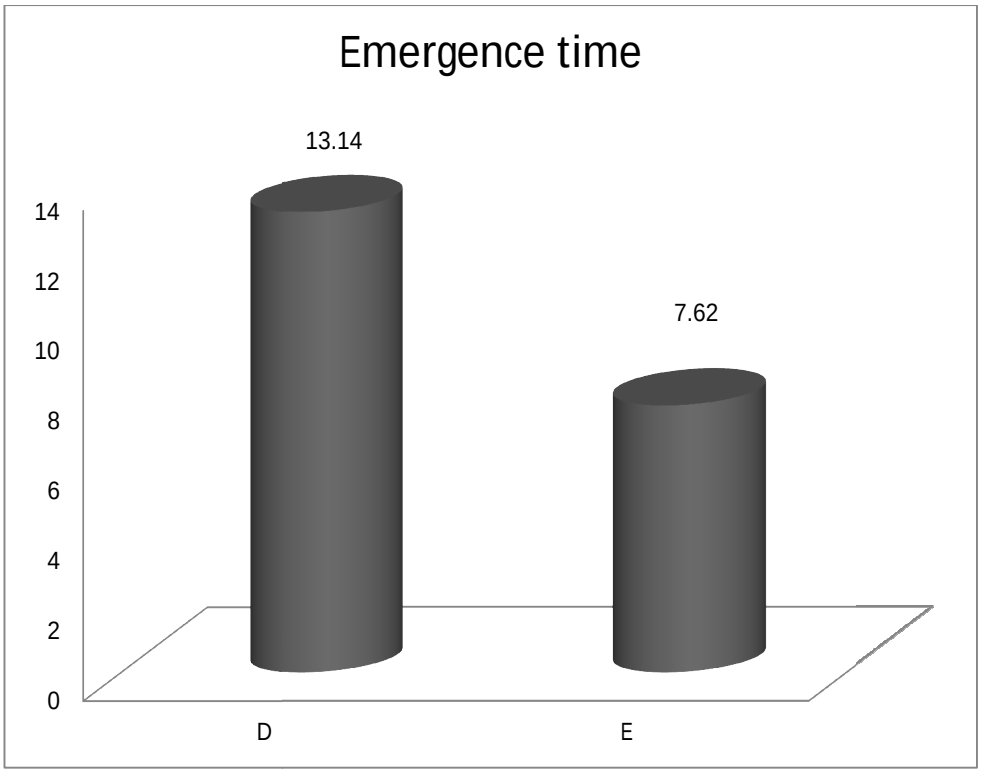
Comparison of quality of surgical field showed no statistical difference between two groups.



5) EMERGENCE TIME(student's t test)

Comparison of emergence time showed statistically significant differences between two groups.Emergence time was significantly higher in group D than group E (P value<0.001).

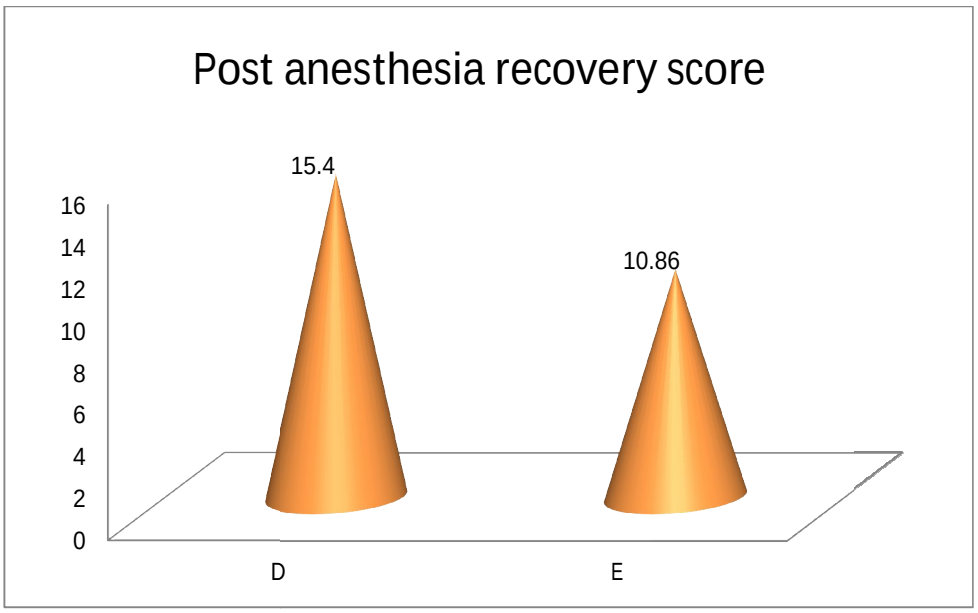
Group	Mean	T value	P value
Group D	13.14±1.1	15.57	0.00
Group E	7.62±1.3		



6) POST ANESTHESIA RECOVERY SCORE-MODIFIED ALDRETE SCORE(student's t test)

Comparison showed statistically significant differences between two groups in the time to achieve modified aldrete score of ≥ 9.The time was significantlyhigher in group D compared with group E (P value <0.001).

Group	Mean	T value	P value
Group D	15.4±1.8	10.89	0.00
Group E	10.86±0.9		

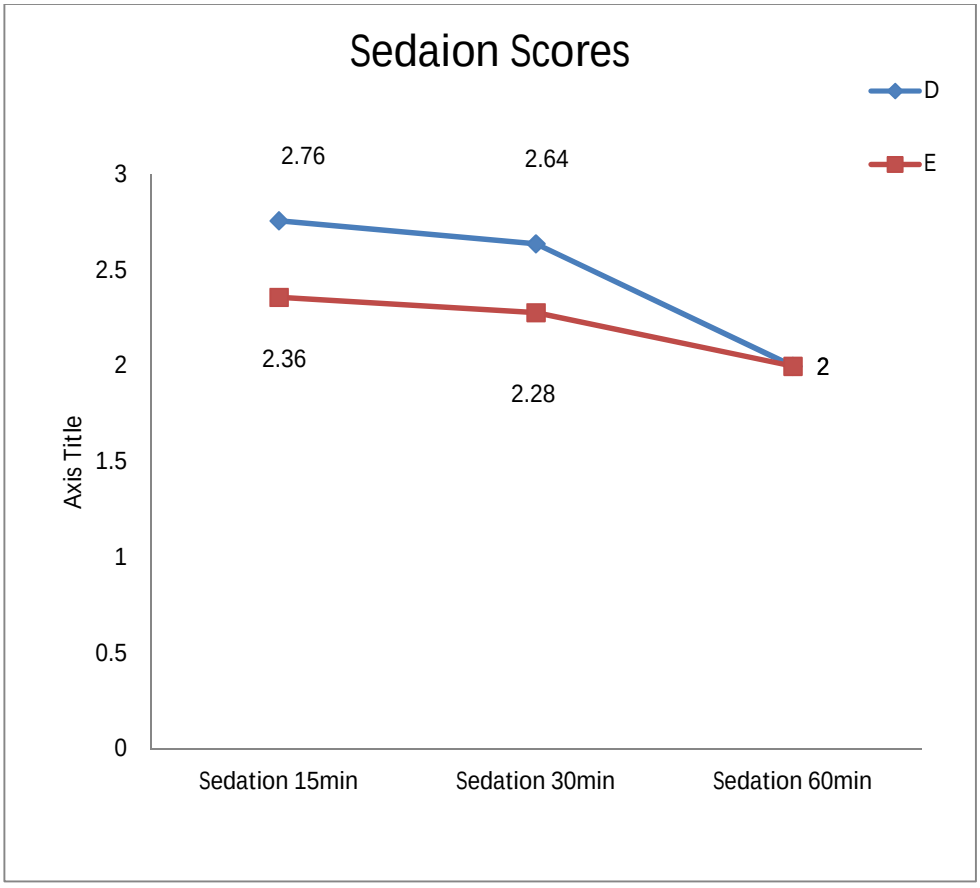


7) SEDATION SCORE-RAMSAY SEDATION SCORE(student's t test)

Comparison between two groups showed that there was statistically significant differences in sedation scores at 15 minutes (p value <0.001)and 30 minutes (p value=0.01)after surgery.

Sedation scores were significantly higher in group D than group E.There was no statistically significant differencein sedation score between two group's at 60 minutes after surgery.

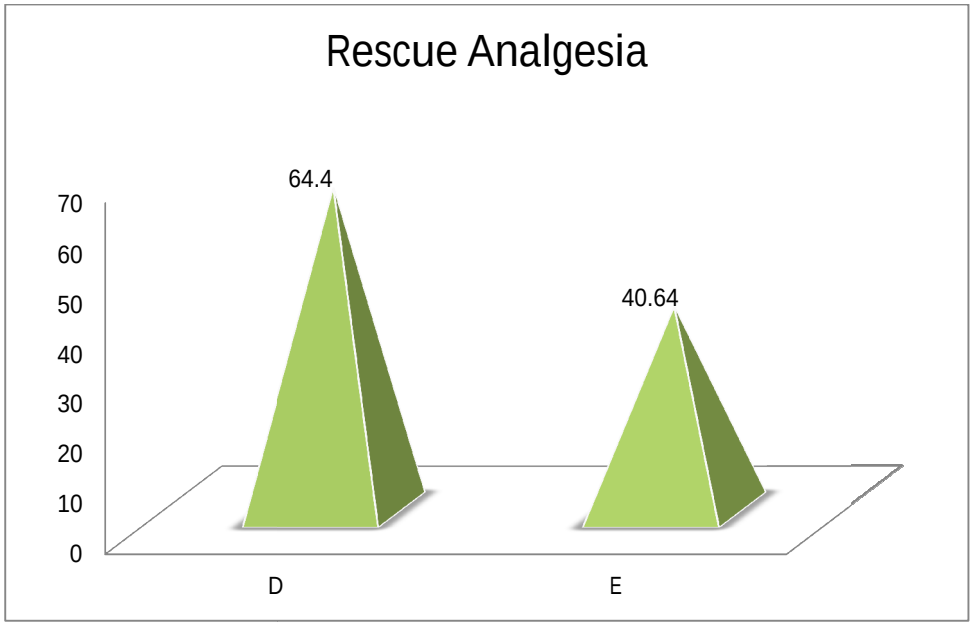
Time	Group	mean	T value	P value
15 minutes	Group D	2.76±0.4	3.05	0.00
	Group E	2.36±0.4		
30 minutes	Group D	2.64±0.4	2.683	0.01
	Group E	2.28±0.4		
60 minutes	Group D	2		
	Group E	2		


Sedaion Scores
D
E
2.76
2.64
2.36
2.28
2
3
2.5
2
1.5
1
0.5
0
Axis Title
Sedation 15min
Sedation 30min
Sedation 60min

8) RESCUE ANALGESIA(student's t test)

Comparison between two groups showed that there was statistically significant differences in the time for rescueanalgesia (p value<0.001).The time for rescue analgesia was significantly higher in group D than group E.

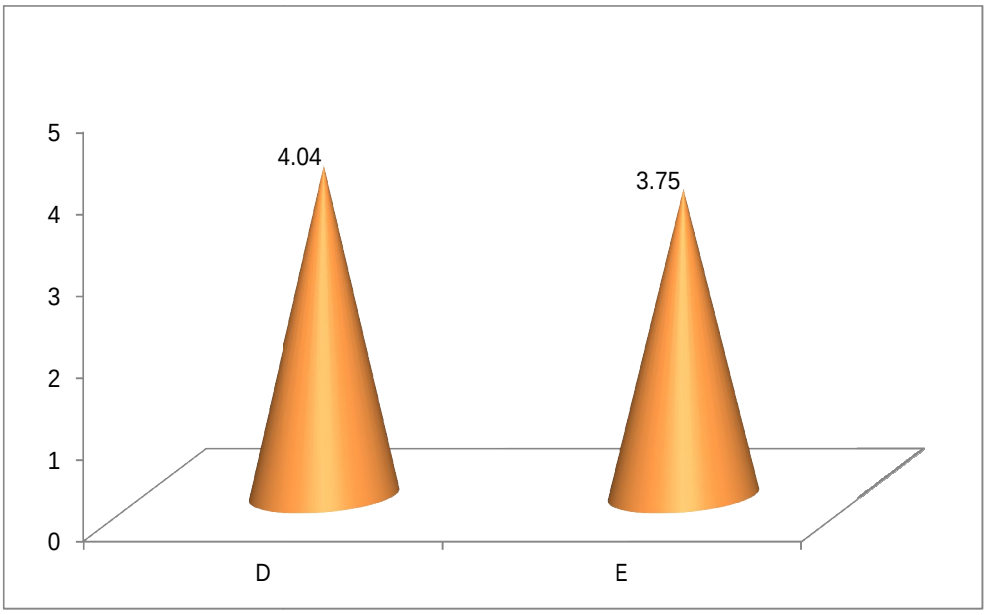
Group	Mean	T value	P value
Group D	64.4±7.9	12.28	0.00
Group E	40.64±5.5		



9) SERUM CORTISOL(student's t test)

Comparison between two groups showed that there was no statistically significant difference in serum cortisol levels intraoperatively (p value=0.07).

Group	Mean	T value	P value
Group D	4.04±0.5	1.83	0.07
Group E	3.75±05		



DISCUSSION

Functional endoscopic sinus surgery is one of the routinely performed surgeries.The use of hypotensive anesthesia during endoscopic sinus surgery has greatly reduced blood loss and improved visibility and quality of surgical field. Many studies have been published ,which have stated the advantages of employing hypotensive anesthesia during endoscopic sinus surgery.

In our study we have compared the effects of dexmedetomidine given at a loading dose of 1microgram/kg over 10 minutes followed by infusion at 0.4-0.8 microgram/kg /hr with esmolol given at a loading dose of 1mg/kg over 1 minute followed by infusion at 0.4-0.8 mg/kg/hr in induced hypotension for endoscopic sinus surgery.

The patients were comparable in both groups with regard's to age and weight.

DOSE OF PROPOFOL

In our study, we found that the dose of propofol required for induction was significantly lower in dexmedetomidine group than esmolol group. The dose of propofol in dexmedetomidine group was (1.24±0.10 mg/kg) and it esmolol group it was (1.65±0.13 mg/kg).

This was consistent with the results obtained by

1) Suvadeep et al(2013) studied the effects of intraoperative dexmedetomidine infusion on requirement of propofol for maintainance of optimum depth of anesthesia during spine surgeries and concluded that dose of propofol was significantly reduced with the use of dexmedetomidine infusion.

2) Kanka et al(2009) studied the effects of dexmedetomidine on anaesthetic requirements in patients undergoing cardiovascular surgery and concluded that the dose of propofol and fentanyl were significantly lower with the use of dexmedetomidine.

HEART RATE AND BLOOD PRESSURE

In our study, we found that the heart rate and blood pressure decreased significantly following administration of loading dose of esmolol and dexmedetomidine followed infusionheart rate and blood pressure intraoperatively (at 5 minutes and 10 minutes after stoppage of infusion) , at the end of surgery and after extubation were significantly lower in dexmedetomidine group than esmolol group.

This was consistent with the results obtained by

1) Shen et at(2001) studied the effects of intravenous infusion of esmolol on patients undergoing endoscopic sinus surgery and found that heart rate and blood pressure significantly decreased with esmolol infusion.

2) Malhotra et al(2013)studied the effects of dexmedetomidine on hypotensive anesthesia in patients undergoing hypotensive anesthesia andfound that mean arterial pressure and heart rate was significantly lower with use of dexmedetomidine .

QUALITY OF SURGICAL FIELD

In our study,the quality of surgical field was assessedusing average category scale and we found that both esmolol and dexmedetomidine were effectivein producing a surgical field with improved visibility(average category scale=2)

This is consistent with the results produced by

1) Farah nasreen et al (2009) studied the effects of dexmedetomidine for patients undergoing middle ear surgery with hypotensive anesthesia and found that the quality of surgical field was greatly improved with use of dexmedetomidine.

2) Boezaart et al(1995) made a comparative study between sodium nitroprusside and esmolol using inducing hypotension in functional endoscopic sinus surgery and found that superior surgical conditions were seen with esmolol even with mild hypotension(MAP>65 mm hg).

EMERGENCE TIME

In our study, we found that the emergence time wassignificantly prolonged in dexmedetomidine group (13.14±1.13 minutes)than esmolol group(7.62±1.36 minutes).

This was consistent with the results obtained by

1) Abdulla aydin ozcan et al(2012) made a comparative study between remifentanil and dexmedetomidine for controlled hypotension in patients undergoing endoscopic sinus surgery and found that recovery time was prolonged in dexmedetomidine group than remifentanil group.

POST ANESTHESIA RECOVERY SCORE

In our study post anesthesia recovery score was assessed using modified aldrete score .we found that post anesthesia recovery (time to achieve modified aldrete score of ≥9) was significantly higher in

dexmedetomidine group(15.4±1.84 minutes) than esmolol group (10.86±0.97 minutes).

This was consistent with the results obtained by

1) Koi io et al(2009) made a comparative study between esmolol and dexmedetomidine combined with desflurane for controlled hypotension during tympanoplasty in adults and found that esmolol group had shorter recovery time than dexmedetomidine group.

2) Turan et al(2007) made a comparative study between esmolol, remifentanil and dexmedetomidine in controlled hypotensive anesthesia and found that post extubation recovery score was longer in dexmedetomidine group than esmolol and remifentanil group.

SEDATION SCORE

In our study post operative sedation scores were assessed using Ramsay sedation score. we found that sedation scores were higher in dexmedetomidine group than esmolol group at 15 minutes(2.76±0.43 vs2.36±0.49) and 30 minutes(2.64±0.49 vs2.28±0.45) and there was no difference in sedation score between two groups at 60 minutes after surgery.

This was consistent with the results obtained by

1) Cr patel et al(2012)studied the effect of intravenous infusion of dexmedetomidine of on perioperative haemodynamic changes and post operative recovery and found that post operative sedation was significantly higher in dexmedetomidine group than control group.

TIME FOR RESCUE ANALGESIA

In our study,the time for rescue analgesia was significantly longer in dexmedetomidine group (64.4±7.91 minutes) than esmolol group(40.64±5.56 minutes).

This was consistent with the results obtained by

1) Gurbet et al(2006) made a study on intraoperative use of dexmedetomidine on post operative analgesic requirements and found that requirement of morphine in the post operative period was lower in dexmedetomidine group and concluded that dexmedetomidine provides excellent post operative analgesia without increasing side effects.

2) Gupta et al(2013) studied the effect on intraoperative dexmedetomidine on post operative recovery in children undergoing spinal surgery and found that post operative agitation

and pain scores were lower in dexmedetomidine group and requirement of analgesic's and time for rescue analgesia was longer in dexmedetomidine group.

INTRA OPERATIVE SERUM CORTISOL

In our study, there was no significant differences between two group's with respect to intraoperative serum cortisol levels.

This is consistent with results obtained by

1) Sarpkaya et al (2010) studied the effects of perioperative use of dexmedetomidine on surgical stress response in hypertensive patients and found that serum cortisol levels were lower in dexmedetomidine group than control group.

SUMMARY

This study was undertaken to compare dexmedetomidine with esmolol in controlled hypotension for functional endoscopic sinus surgery.

A total of 50 patients were randomly allocated into two groups .Group D received dexmedetomidine at a loading dose of 1 microgram/kg followed by infusion at a dose of 0.4-0.8 microgram/kg/hr.

Group E received esmolol at a loading dose of 1mg/kg followed by infusion at 0.4-0.8 mg /kg/hr.

Various parameters like dose of propofol, intraoperative heart rate and blood pressure, quality of surgical field, emergence time, post anaesthesia recovery score, sedation score, intra operative serum cortisol, time for rescue analgesia was recorded.

The observation noted were as follows

- The induction dose of propofol was lower in dexmedetomidine group than esmolol ,which was statistically significant.
- Heart rate and blood pressure was significantly lower in dexmedetomidine group than esmolol group at 5 and 10 min's after stoppage of infusion, at end of surgery and after extubation.
- The quality of surgical field was comparable between two groups.
- Emergence time was significantly prolonged in dexmedetomidine group than esmolol group.
- Time to achieve post anaesthesia recovery score (modified aldrete score>9)was significantly higher in dexmedetomidine group than esmolol group.
- Sedation score's were higher in dexmedetomidine group than esmolol group at 15 min's and 30 min's after extubation.
- Time for rescue analgesia was significantly higher in dexmedetomidine group than esmolol group.
- Intra operative serum cortisol level's were comparable between two group's.
- No adverse complications were noted in both group's.

CONCLUSION

The observation of this study is that both esmolol and dexmedetomidine can be effectively used in induced hypotension for functional endoscopic sinus surgery. Both groups were comparable with respect to quality of surgical field and intraoperative haemodynamics.

This study also shows that dexmedetomidine has added advantage of sedative,analgesic and reduced requirement of anaesthetic agents when compared with esmolol. Post operative recovery scores and sedation scores were significantly higher and time required for rescue analgesia was also prolonged with dexmedetomidine than esmolol.

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PROFORMA

Name:

Age:

Sex:

Weight:

Diagnosis:

Surgery:

MPC:

ASA PS class:

Group:

parameters		
Dose of propofol		
Heart rate	Pre op	
	After induction	
	15 min of surgery	
	30 min of surgery	
	45 min of surgery	
	5 min after stop	
	10 min after stop	
	At end of surgery	
	After extubation	
Blood pressure	Pre op	
	After induction	
	15 min of surgery	
	30 min of surgery	
	45 min of surgery	
	5 min after stop	
	10 min after stop	
	At end of surgery	
	After extubation	
Intra op plasma cortisol		
Quality of surgical field		
Emergence time		
Post op recovery score		
Sedation score	15 minutes	
	30 minutes	
	60 minutes	
Time for rescue analgesic		

MASTER CHART GROUP D

group	Name	age	sex	wt	Sbp preop	Dbp preop	Sbp after int	Dbp after int	sbp15mi	dbp15mi	sbp30mi	dbp30 min	sbp45mi	dbp45mi	sbp5 min af stop	dbp5mi n af stop	sbp10mi af stop	dbp10 min af stop	Sbp at end	Dbp at end	Sbp af ex	Dbp af ex
1	Perumal	38	1	50	120	72	108	70	90	58	90	56	90	58	94	60	96	62	98	70	102	71
1	Thamilarasi	31	2	65	120	70	110	71	93	52	90	54	90	58	98	64	96	60	100	62	103	63
1	Verrakannan	21	1	50	125	60	106	70	98	54	86	52	80	53	98	58	100	60	96	70	98	74
1	Gajendran	42	1	70	120	70	110	70	96	58	80	52	80	54	92	60	93	65	94	66	97	70
1	Rukumani	36	1	40	116	78	105	70	88	55	88	56	80	58	94	63	93	60	96	66	98	63
1	Raguram	26	1	60	120	70	106	70	89	58	85	52	84	58	90	66	94	68	96	65	99	66
1	Latha	30	2	50	110	78	100	74	90	50	88	52	86	50	90	54	93	62	98	60	103	70
1	Sasikala	34	2	55	106	72	102	66	91	58	80	58	88	54	90	62	96	67	92	64	105	70
1	Thenmozhi	40	2	45	120	70	120	68	99	52	90	56	80	54	96	62	95	60	93	60	103	63
1	Sathish	30	1	75	114	70	110	70	84	58	88	56	85	50	90	62	93	60	98	62	98	66
1	Karthick	28	1	65	120	71	117	66	82	56	84	56	88	54	94	64	98	60	102	62	103	63
1	Manimaran	45	1	55	120	72	111	60	89	58	86	52	90	56	92	58	90	57	94	69	98	66
1	Dinesh	23	1	60	117	80	110	70	93	58	90	60	88	54	90	62	93	63	98	60	101	65
1	Suganya	27	2	50	110	70	108	70	90	60	85	54	92	56	94	60	98	61	90	64	102	66
1	Vijayalakshmi	33	2	40	120	68	112	66	92	54	80	58	92	54	95	58	90	50	94	63	104	65
1	Subash	27	1	60	120	76	120	72	84	58	80	54	86	60	90	64	93	70	90	66	96	68
1	Nithya	30	2	50	120	78	116	70	83	60	84	60	88	63	92	66	97	62	94	60	97	64
1	Geetha	36	2	65	117	70	112	72	86	54	84	60	86	64	90	68	93	60	96	63	98	68
1	Vularmani	48	2	50	112	80	104	72	90	58	82	60	90	56	92	60	95	63	94	64	98	63
1	Umakannan	40	1	60	114	70	107	66	94	63	90	60	82	64	94	60	97	60	98	68	101	70
1	Lakshmi	37	2	50	126	80	112	66	84	60	85	63	88	60	90	62	92	60	96	64	98	67
1	Senthamarai	43	2	55	120	79	114	72	88	56	84	58	88	70	93	72	98	66	90	70	106	73
1	Kalyani	23	2	60	121	84	107	70	96	58	90	62	94	56	95	55	95	60	94	68	110	74
1	Karunakaren	35	1	70	109	70	104	76	90	58	90	62	94	58	91	55	90	56	94	60	108	74
1	Kannan	24	2	50	117	85	112	80	84	62	86	56	90	60	88	57	90	58	98	66	104	65

Pre op hr	Af intubation	Hr 15 min	Hr 30 min	Hr 45 min	Hr 5 min af stop	Hr 10 min af stop	At end of surgery	After extubation
86	72	62	62	56	56	62	64	67
84	70	62	62	56	56	64	66	66
86	66	60	66	54	50	63	68	68
84	66	60	68	54	54	64	65	66
80	70	62	70	56	60	68	70	71
70	70	60	60	56	58	63	65	64
76	66	62	60	58	58	61	64	66
80	66	62	62	56	54	62	65	67
84	70	66	66	58	60	67	69	70
90	70	62	70	56	60	71	73	71
86	66	60	74	58	60	75	77	78
82	66	60	63	58	60	60	62	63
76	66	60	58	55	55	60	64	65
86	70	60	67	58	65	66	68	69
68	60	56	52	50	50	54	56	60
74	66	60	61	59	60	61	62	65
70	60	56	54	51	53	55	57	60
80	72	64	64	58	64	65	66	68
78	66	60	66	56	69	70	73	71
88	66	60	69	58	72	71	72	74
92	66	60	71	58	68	70	73	75
90	66	60	67	60	71	72	74	76
76	66	60	58	56	56	57	59	63
94	70	62	71	60	72	73	74	78
92	72	64	70	58	70	74	75	78

Average category scale	Dose of propofol	Emergence time	Postanesthesia recovery score	Rescue analgesia	S 15 mins	S 30 mins	S 60 mins	Serum cortisol
2	70	12	15	60	3	3	2	4
2	80	12	15	65	3	2	2	3
2	60	12	14	55	3	3	2	3
2	80	13	14	65	3	3	2	4
2	50	14	16	70	3	3	2	4
2	75	15	17	75	3	3	2	5
2	65	13	14	80	3	3	2	5
2	65	16	16	65	3	3	2	4
2	60	11	15	60	3	2	2	4
2	90	13	14	60	2	3	2	5
2	80	13	15	70	3	3	2	4
2	75	14	16	75	2	2	2	3
2	70	14	16	62	3	3	2	4
2	60	13	11	45	3	3	2	4
2	60	13	18	80	2	2	2	4
2	70	14	15	55	3	3	2	5
2	60	14	16	60	3	2	2	5
2	70	15	16	65	3	3	2	4
2	70	14	17	70	2	2	2	4
2	65	12	11	60	3	3	2	4
2	60	13	16	65	2	2	2	4
2	70	13	18	65	3	3	2	4
2	70	13	17	60	2	2	2	4
2	80	14	18	63	3	3	2	3
2	70	13	18	60	3	2	2	4

GROUP E

group	Name	age	sex	wt	Sbp pre op	Dbp pre op	Sbp after intu	Dbp after intubation	Sbp 15 min	Dbp 15 min	Sbp 30 min	Dbp 30 min	Sbp 45 min	Dbp 45 min	Sbp 5 min af stop	Dbp 5 min af stop	Sbp 10 min af stop	Sbp at end	Dbp at end	Dbp at end	Sbp af ex
2	Rajasekar	21	1	85	120	80	110	70	96	52	90	50	94	54	106	57	107	70	108	114	78
2	Bala	50	2	40	120	70	100	74	92	58	88	54	91	54	109	62	106	64	112	120	74
2	sivakumar	21	1	50	130	80	110	76	96	56	94	60	93	62	110	63	114	71	116	126	80
2	Suganthi	27	2	60	126	74	116	76	100	50	93	58	90	54	104	70	116	81	114	124	80
2	Mythili	23	2	60	117	80	112	76	104	76	91	60	88	60	108	74	117	83	124	120	84
2	Tamilarasi	31	2	65	128	76	120	78	108	86	88	58	84	62	112	76	120	76	126	118	81
2	Jothi	31	2	54	108	76	106	80	98	58	99	60	93	62	120	72	114	76	117	118	80
2	Mohanapriya	22	2	45	114	72	110	72	90	56	80	58	84	62	107	78	108	82	110	100	70
2	Revathi	40	2	50	120	80	110	70	90	62	93	64	90	66	106	84	110	82	111	110	84
2	Suresh	27	1	60	116	73	114	74	96	63	90	60	92	62	102	78	106	76	121	124	82
2	Ramesh	30	1	55	127	90	120	76	86	60	85	65	84	60	109	70	114	76	110	116	83
2	Ramkumar	34	1	60	134	94	130	80	94	70	90	62	94	68	118	80	111	86	112	114	82
2	Ratnavel	47	1	68	130	82	126	76	90	72	92	67	90	61	112	72	114	76	111	120	86
2	Chitra	26	2	43	121	70	120	88	87	57	90	56	94	60	116	71	118	70	110	122	72
2	Shobana	28	2	48	114	80	110	70	88	53	92	58	96	60	121	70	118	78	120	124	84
2	Sukumar	22	1	50	112	68	110	62	92	51	90	56	88	60	108	81	126	70	124	126	79
2	Ravi	33	1	55	126	70	112	70	94	58	93	62	95	66	113	70	120	76	126	120	76
2	Ganesh	38	1	60	120	77	114	72	91	60	96	62	94	63	111	74	114	80	120	124	80
2	Selvakumar	40	1	53	114	84	106	80	95	56	90	62	93	60	110	71	118	81	123	116	80
2	Prabu	26	1	70	120	86	120	70	96	66	93	62	90	64	126	76	120	81	114	115	84
2	Karpagam	38	2	62	128	78	118	71	85	60	90	64	92	60	110	71	126	84	125	106	84
2	Praveen	21	1	68	132	80	120	76	87	64	88	62	85	60	114	76	116	80	110	126	83
2	Senthil	35	1	60	130	84	114	70	93	68	83	68	90	60	112	62	114	76	116	120	72
2	Sridhar	38	1	50	136	88	120	70	90	62	90	62	94	63	126	78	124	84	120	120	84
2	Sakthivel	47	1	55	120	70	110	62	89	63	89	63	95	66	114	82	112	76	110	113	80

Preop hr	Af intubation	Hr 15 min	Hr 30 min	Hr 45 min	Hr 5 min af stop	Hr 10 min af stop	At end of surgery	After extubation
92	72	64	70	58	70	74	75	78
84	68	64	60	60	68	72	72	76
90	70	62	60	58	66	70	74	74
96	80	72	70	72	80	86	86	88
90	76	70	68	66	70	74	76	80
80	70	64	62	62	68	70	72	80
86	76	66	64	66	70	74	74	90
92	80	68	62	60	64	68	70	82
72	60	52	52	50	58	64	66	76
86	70	66	62	60	64	66	70	78
78	62	56	52	50	56	62	64	70
98	72	60	58	56	62	66	68	76
104	86	72	68	64	70	76	74	80
78	64	56	54	52	60	66	64	78
84	70	60	56	52	56	60	64	70
90	72	62	60	58	66	70	72	76
96	80	72	66	64	70	76	78	86
100	84	76	70	70	76	82	84	90
92	72	68	64	64	72	78	80	90
80	64	60	54	52	60	64	68	80
86	66	58	52	54	62	66	70	82
84	60	56	54	56	62	68	72	82
78	64	60	56	54	64	70	70	80
90	75	70	66	68	76	80	84	90
96	80	74	70	66	74	80	86	90
78	62	56	54	52	58	66	70	84

Average category scale	Dose of propofol	Emergence time	Postanesthesia recovery score	Rescue analgesia	S 15 mins	S 30 mins	S 60 mins	Serum cortisol
2	70	13	18	60	3	2	2	4
2	150	5	10	35	2	2	2	3
2	70	7	11	40	3	3	2	4
2	75	7	11	42	2	2	2	5
2	100	8	12	30	2	2	2	3
2	90	6	9	45	3	3	2	4
2	100	9	11	40	2	2	2	4
2	90	8	10	50	2	2	2	3
2	80	6	11	35	2	2	2	3
2	80	7	11	45	3	3	2	3
2	110	8	12	40	2	2	2	3
2	80	9	12	46	2	2	2	4
2	90	6	13	48	2	2	2	4
2	100	6	11	35	3	3	2	4
2	70	8	10	30	3	2	2	3
2	90	9	11	40	2	2	2	3
2	90	10	11	45	2	2	2	3
2	100	8	12	40	2	2	2	3
2	90	7	12	35	3	3	2	4
2	80	8	13	45	2	2	2	4
2	120	8	12	50	2	2	2	4
2	100	9	11	40	3	2	2	4
2	120	10	11	45	2	2	2	4
2	100	9	10	40	3	3	2	4
2	90	7	9	40	2	2	2	3
2	90	8	10	35	3	3	2	5